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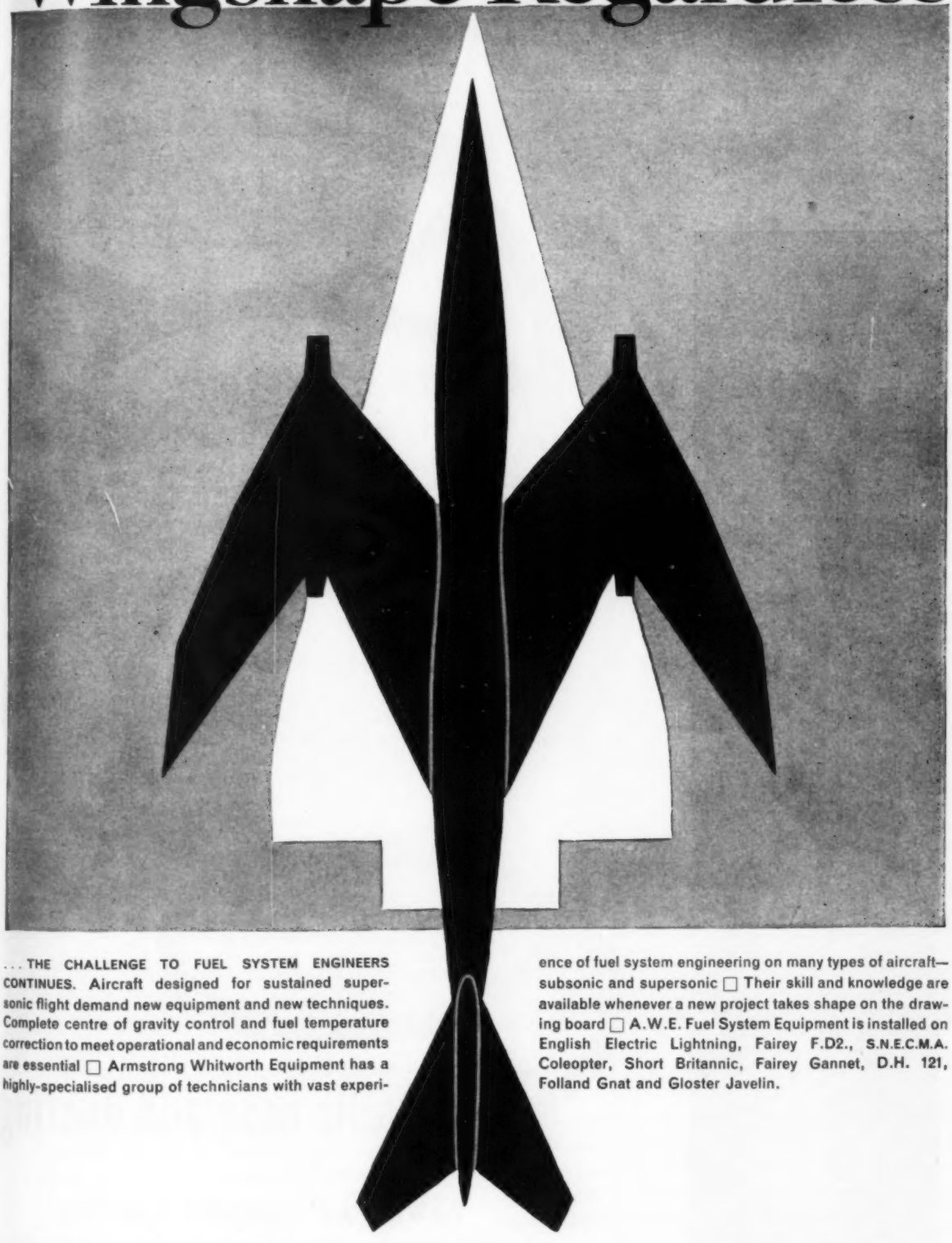

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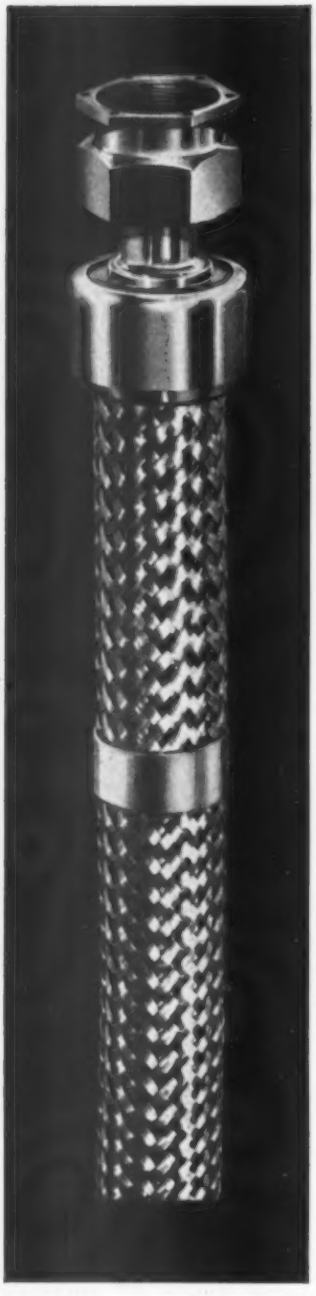

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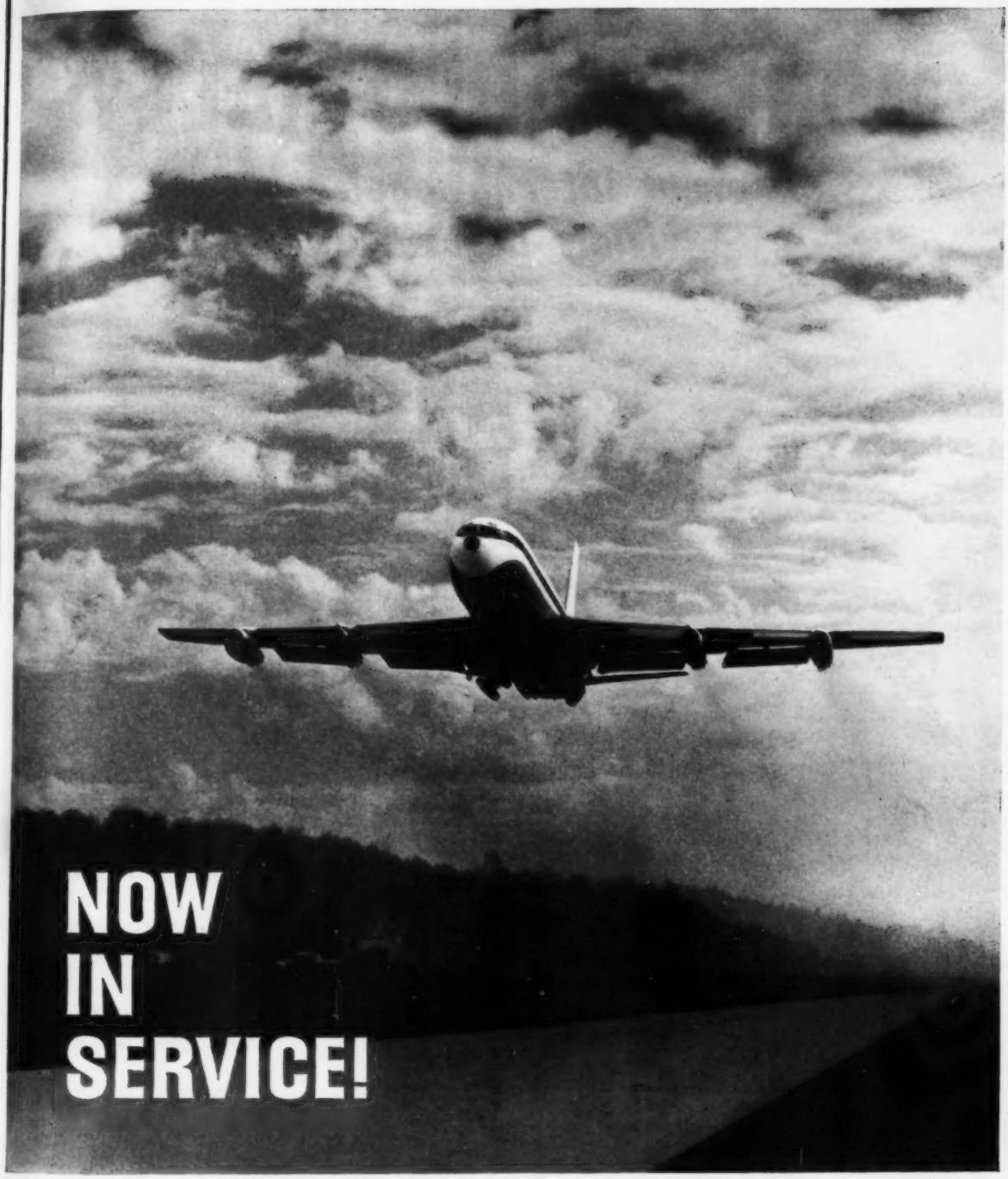

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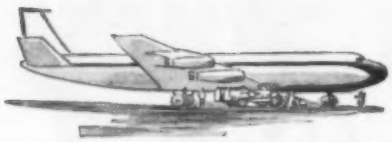

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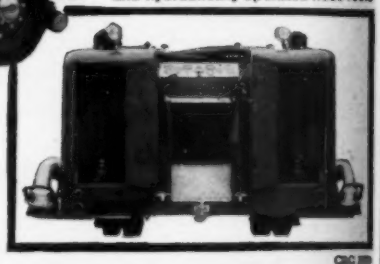

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FLIGHT

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Aviation's Future Laws

IN the race that is human progress it seems inevitable that the law will tail along behind science and technology. It is accepted that legal rules cannot keep pace with the new facts, processes and ideas of scientific thought and action. But as far as aviation is concerned it has been left to Mr Harold Caplan, in the Royal Aeronautical Society lecture reported on pages 79-80 of this issue, to call attention to the seriousness of this situation and its implications, to question its inevitability, and to suggest what might be done about it.

The descriptive phrase "legal drag" was coined by the lecturer to indicate the resistance to progress—which could eventually turn into a danger to the livelihood of aeronautical engineers—caused by (1) regulations governing scheduled and non-scheduled air traffic, (2) the prospect of restrictive rules concerning supersonic transports, and (3) the tyranny of documentation. A further conflict is the discrepancy between technical responsibility and legal liability in, for example, the case of aircraft accidents. The scientific facts could indicate the technical cause of the accident, and hence the technical responsibility. From the same set of basic facts, however, a different answer could be produced—that of the legal or financial responsibility, as determined by illogical laws and limited or exemption-ridden contracts.

Priorities in Space

It was in his discussion of space exploration, however, that Mr Caplan brought out his most progressive cat to set among the legal pigeons. Criticizing the school of legal thought which attached the highest priority to things such as definitions of "sovereignty" and the regime of "space law," he commented "National sovereignty should be left where it is—a creation of the essentially earthbound past: a monument to the horizontal limit of the imagination of statesmen." In this view, as in others, Mr Caplan was well ahead of most members of his audience, but it is to the credit of the Society that its *Journal* will carry these words, as part of the complete paper, in 1961.

But idealism and the future were not all which the speaker had to offer. He cited the IGY, with its scientific co-operation and international consent to satellite launching; and the Antarctic Treaty, in which twelve nations had agreed not to claim sovereignty in that region. The majority of *immediate* space-law problems were scientific or technical rather than legal, he suggested, and useful work could begin now.

Whether or not the Royal Aeronautical Society adopts the Caplan proposal for a law reform committee, whose task would be to apply aeronautical and allied sciences to the evolution of law, its members would do well to recognize and study two points, in particular, from the conclusions to this broad-thinking paper. First, because there has been little direct consultation with scientists in the evolution of law, legal rules often act as a seriously limiting operational factor in aeronautics. Secondly, to avoid this—i.e., to avoid "strangling the future of aeronautics with the noose of ancient thought embodied in our law"—scientists, lawyers and law-makers must find ways to collaborate, both in identifying the important problems and evolving creative solutions. If this collaboration is not achieved the scientific exploration of space itself may be halted, simply because lawyers and politicians have not reached agreement. And aeronautical activity will indeed remain "a blind technological tool of an imperfect civilization."

FROM ALL QUARTERS

Anglo-German Co-operation

TALKS in Bonn last week between the Minister of Aviation, Mr Peter Thorneycroft, and West German Defence Ministry officials resulted in an announcement that Britain and West Germany were to enter into negotiations on the joint development of a VTO lightweight strike fighter and that the Federal Government was to purchase a number of Short Seacat surface-to-air missiles for trial purposes.

A statement issued after the talks included the following points:

"The United Kingdom and the Federal Republic wish to enter into negotiations in the near future for the joint development of a vertical take-off lightweight strike fighter on the basis of the British project P.1127, which is a successor to the Fiat G.91. Other NATO countries will be invited to join in this development project.

"The existing extensive co-operation in the development of new aircraft engines and in their application will be furthered by the British Government, in that they will consider sympathetically proposals made by the German Government. The Federal German Government will purchase from the United Kingdom Seacat surface-to-air missiles for trial purposes.

"The Government of the United Kingdom and the Federal German Republic hold the same views on new weapons for defence against low-flying aircraft. The British Government intend to expand the tripartite co-operation existing in this field between France, Italy and the Federal Republic, by participating in this joint effort and thus giving it a broader basis."

During his visit Mr Thorneycroft also outlined Franco-British plans to hold a conference at Strasbourg on January 30 to consider the setting-up of an international organization for research into a satellite for peaceful purposes—a proposal in which German representatives expressed interest, but said that it required further study.

Export Prospects for Airpass 2

IN London on Tuesday, Mr Powley, Ferranti's divisional manager of electronic and inertial systems, stated that no firm order had yet been placed for fire-control equipment for either Swiss or Australian Mirage IIIs. An Australian technical mission was expected in Europe and might visit Ferranti to examine Airpass 2, which was officially acknowledged for the first time to incorporate a high-powered monopulse radar. The Swiss government had asked for detailed specifications and proposals. Neither country was likely to make a decision before the middle of this year.

The main competitor for Airpass 2 was the French CSF Cyrano which, Ferranti claim, is heavier and has fewer capabilities. It is also two or three years behind Airpass 2 in development. Airpass 1, using the same radar, had 1,200hr operation and two years of production as well as squadron service behind it already. Combined Airpass 2 export orders were potentially worth between £5m and £10m.

Orpheus Order from Japan

A FURTHER order for Bristol Siddeley Orpheus 805 turbojets has been placed with the company by the Defence Agency of Japan. This is the second such order to be placed by the Agency within the past fourteen months. The 805, rated at 4,000lb thrust, forms the powerplant of the Fuji T1F-2, the standard intermediate/advanced trainer for the Japanese Air Self-Defence Force.

Royal Tour Dakotas

DAKOTAS have been chosen as Royal aircraft for flights in the Nepalese sector of the Asian tour on which the Queen and the Duke of Edinburgh leave by BOAC Britannia from London Airport today (Friday). They are considered to be "the most suitable proven type" for the conditions involved. Katmandu, into which Indian Airlines and Royal Nepalese Airlines operate DC-3s, provides the only airfield in the country with an all-weather runway (800yd long) and is about 4,000ft a.s.l. During the tour, the Queen is to fly from Benares to Katmandu and thence to Delhi.

The decision to use Dakotas was taken by the Secretary of State for Air and the Minister of Aviation "after full consideration of other possible types," including the D.H. Herons of the Queen's Flight (which lacked the carrying capacity for use in Nepal) and the Handley Page Herald. Though the latter was considered "fully capable of the task," the first production model only received its C of A on January 5 and the aircraft had never been flown under normal military or airline conditions.

The Dakotas being employed are KN645, which was used by Viscount Montgomery for some years after the war, and KN452. The latter recently returned from Malta, where it had been used by the AOC for special flights. Air Ministry stated last week that both aircraft were "in excellent condition."

FEDERAL AUTOLANDING APPROPRIATION: Grouped at Cheltenham for the signing of the contract to fit Smiths automatic landing equipment in a Federal Aviation Agency DC-7 are, left to right, Mr James L. Anast, director of the FAA Research and Development Bureau; Mr R. D. Munnikhuysen and Mr D. J. Sheftel, both of the FAA; Mr K. Fearnside, Smiths director of research and engineering; Mr A. M. A. Majendie, their director of operational requirements; and Mr A. G. Stirling, manager of the project. Murphy Leader Cable will also be evaluated in the same aircraft later this year

Jet Fuel and Safety

COMMENTING on *Flight's* leading article last week, under the above title, Lord Brabazon writes to the Editor:—

Dear Sir,—I regret I must take you up on one point relative to your excellent leading article of January 13. I have never ever spoken on the subject of the use of JP.4 as chairman of the Air Registration Board. The Council has never even discussed the matter. They have very rightly certified jet engines as airworthy with either JP.1 or JP.4. To go beyond that would be outside their province.

I have spoken as the man in the street, or more particularly as the man in the aeroplane, and I have stuck to one point and one point only (which I note you endorse in your leading article)—namely, that in a minor crash of an aeroplane using kerosine, passengers have a better chance of survival. I appreciate that at last someone has tried to put the case for JP.4. Most of it from TCA is old stuff which we all know about. The author is like the soldier claiming he is the only man in the regiment in step, as operators on JP.4 are still, I am glad to say very much in the minority.

I am not impressed at all by Mr Dyment's defence of JP.4, and, of course, his statement that as chairman of the Air Registration Board I am a political appointee is quite wrong. Politics never entered into my appointment.

The point I have striven to make is a simple one. You don't want to be an expert to understand it; all that it requires is that you should not be a half-wit. The trouble is that some operators have such a very low opinion of the intelligence of their passengers, amongst whom is included—*Your obedient servant, Brabazon of Tara.*

[Lord Brabazon described the use of JP.4 by airlines as a "disgraceful practice" at the Air Registration Board luncheon in London last July (*Flight*, July 22). This opinion was thus widely construed to be that of the Board.]

SUB-KILLER: The US Navy recently released pictures of the Lulu nuclear depth bomb developed at the Naval Ordnance Laboratory at Silver Spring, Maryland. Lulu is here carried by a Sikorsky HSS-1

CLAY-PIGEON BROOD: Nestling under the wings of this Lockheed GC-130A taking off from Tyndall AFB, Florida, are four Ryan Q-2C drones. The GC-130A will direct the complete mission of these targets, which can climb to twice the normal release height of 30,000ft

Propellers for the Transall

LAST week we reported the signing of an £875,000 contract for Rolls-Royce Tyne engines for the first three Transall C-160 transports. After that issue had closed for press the de Havilland Aircraft Co (there is now no separate propeller company) announced a contract "worth nearly £500,000" for the propellers for the same three aircraft. Although evolved directly from the units designed for the Vanguard, the Transall propellers will have a diameter of 18ft, making them the largest yet produced in this country, and equal in size to the largest being made in the USA. The C-160 is likely to have Tynes more powerful than any currently in use; they may well be similar to the Tyne 20s of the Breguet Atlantic, for which a propeller contract was received by de Havilland late last year.

Another Transall order, worth £40,000, has been placed with Normalair Ltd, who are to supply all the cabin air conditioning and pressurization equipment for the three prototype C-160s.

Four-jet Hustle

IT was announced by the USAF from Edwards AFB, Cal, last weekend that on January 14 a Convair B-58 Hustler had averaged 1,284.73 m.p.h. over a 1,000km (621-mile) desert course. Subject to FAI confirmation, it thus broke three of the world speed records set up by another B-58 on January 12. These were for flights over a 1,000km course with payloads of 2,000kg (about 4,400lb), 1,000kg and no payload. On January 14 the B-58 carried 2,000kg and therefore automatically established records for lesser loads. The aircraft which flew on January 12 averaged 1,200.194 m.p.h.

The USAF have stated that the crew of the B-58 which established the new figures will be awarded the 1961 Thompson Trophy, given to Service personnel for outstanding air speed achievements.

Soviet Negotiations with India

IN Calcutta on January 9 the Soviet trade representative in India, Mr Nikolai Shiryaev, told a Press conference that the Soviet Union was prepared to supply India with any number of jet aircraft of the latest type, for which payment in Indian currency would be accepted. Negotiations between the two countries had been concluded in Moscow, and the Soviet Government was awaiting India's reply. He did not say whether the aircraft were for the Indian Air Force or the State-owned airlines.

The Reuter report adds that the following day an Indian Defence Ministry spokesman commented that he had "no information" about Mr Shiryaev's statement.

IN BRIEF

It is estimated that the airlift mounted by the RAF to take Ghanaian troops and technicians to the Congo has so far cost about £2.5m.

Sikorsky Aircraft announced on January 4 that they had delivered two S-58s to the Russian Government.

The former British aircraft carrier *Vengeance* (20,000 tons) left Rotterdam for Rio de Janeiro last week on her maiden voyage as the modernized Brazilian carrier *Minas Gerais*.

Three Piaggio P.166 six-seat executive aircraft are being made available by McAlpine Aviation of Luton Airport for hire to companies needing an executive air-transport service. The aircraft will be leased together with pilot at a set fee for a specified number of flying hours.

The first Piper Colt to be imported into Britain has arrived in this country. Vigors Aviation Ltd, the UK Piper distributors, had already received orders for 13 Colts prior to the arrival of this machine. Vigors have appointed the Oxford Aviation Co Ltd of Kidlington and Elmdon as sole agents for the sale of Piper aircraft "from Oxford to the Scottish border."

The Tom Nevard Cup was presented by Mr Henry Hardman, CB, Permanent Secretary, MoA, to Craft Apprentice Geoffrey Clements of the RRE, Malvern, in London on January 10. Named after the late Tom Nevard, MBE, a former Assistant Secretary in the MoS Labour Branch, the cup is awarded annually to the apprentice at MoA or War Office establishments showing the best all-round qualifications in craftsmanship.

The FAI have approved three French international records set up during 1960, one by Maj Rene Bigand for an average speed of 1,822km/hr (1,132.13 m.p.h.) round a 1,000km closed circuit in a Dassault Mirage IV on September 19, and the other two by Raymond Davy on October 13. These were for aircraft weighing less than 500kg (1,102lb) on a 100km closed circuit, Davy flying a Rene Leduc 21 at average speeds of 313 and 317km/hr (194.48 and 197.17 m.p.h.); and for machines weighing from 500 to 1,000kg, the pilot covering the same circuit at a speed of 316km/hr (196.34 m.p.h.).

United Aircraft disclose that the Pratt & Whitney JT8D-1, powerplant of the Boeing 727, has a 13-stage compressor system and four turbine stages (undoubtedly one high-pressure and three low-pressure). Prototypes will be available for "airframe manufacturers' testing" in mid-1962.

Beech Aircraft Corporation and SFERMA, a subsidiary of Sud, have signed an agreement for further development and application of turboprops to Beechcraft aeroplanes. SFERMA have already fitted Turboméca Bastans to a Beech 18 and Astazous to a Travel Air.

Mr Charles G. Keil, BSc (Eng), has been appointed editor of *Aircraft Engineering* from January 1. Lt-Col W. Lockwood Marsh, OBE, FRAeS, MSAE, FIAS, formerly editor, becomes managing editor. Mr Keil, who is 27, served with the RAF as a pilot from 1951 to 1955. He joined *Aircraft Engineering* in August 1959 as technical editor.

Mr H. Guyford Stever, professor of aeronautics and astronautics at MIT, has been elected 1961 president of the Institute of the Aerospace Sciences. He is to take office next Monday (January 23) at the annual IAS business meeting in New York, and at the honours-night dinner the following evening will speak on the future of space exploration.

The Miles Organization have announced the appointment of Mr J. W. C. Judge as pilot and aerodrome supervisor at Shoreham Airport. Mr Judge served in the RAF during the war and afterwards with No 615 (County of Surrey) Sqn, RAuxAF. He has been a test pilot at the Supermarine works of Vickers-Armstrongs (Aircraft) Ltd and with Rolls-Royce Ltd.

A licence agreement between the Vertol division of the Boeing Airplane Co and the Kawasaki Aircraft Co of Japan, giving Kawasaki exclusive rights for the manufacture and sale of Vertol 107 helicopters and parts in Japan, and non-exclusive rights for sale of the helicopters in certain South-east Asia countries, has been approved by the Japanese Government.

Helicopter Services Ltd, Luton Airport, Beds, have pointed out that in November 1959 they used a Bell 47G for pipelaying at Fort William, Inverness-shire, and claim that this was the first helicopter operation of its type in Britain. A similar claim, for pipelaying by a Widgeon over marshes near Gravesend, on January 10, had been made by British United Airways last week (*Flight*, January 13).

Stages in the Development of Modern Meteorology is the title of a university extension course of six weekly lectures being given at Imperial College, London SW7, from February 9 to March 16. The lecturers are F. H. Ludlam, DSc, reader in meteorology, Imperial College, and G. B. Tucker, PhD, scientific officer, Meteorological Office, and applications (10s for the full course, 2s for single lectures) should be addressed to the Cashier, University of London, Malet Street, WC1, with the envelope marked "Extension Courses."

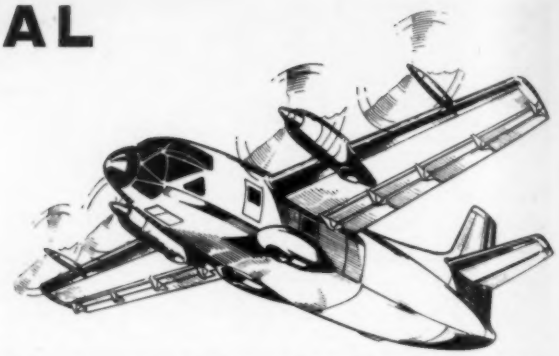
***VISITOR FROM WEYBRIDGE:** Sir George Edwards (right), managing director of Vickers-Armstrongs (Aircraft) Ltd and executive director (Aircraft) of the British Aircraft Corporation is greeted by Sir Arnold Hall (left), managing director of Bristol Siddeley Engines Ltd on arrival for a visit to Bristol Siddeley's Patchway, Bristol, works. Also in the picture are Sir Alec Coryton, deputy chairman (Bristol) of Bristol Siddeley, and Air Marshal Sir Geoffrey Tuttle, a director of Vickers-Armstrongs (Aircraft) Ltd*

LIGHT TACTICAL TRANSPORT

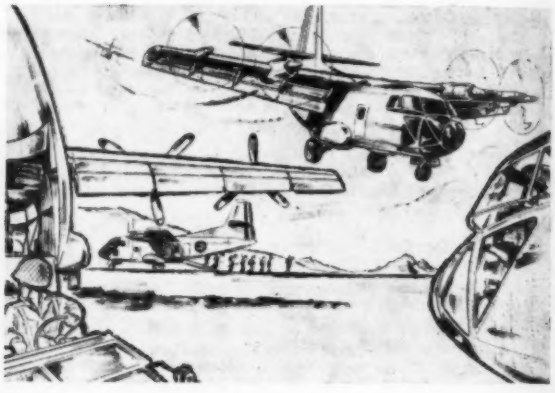
Three-way Competition in France

KEEN competition recently centred round the selection of a light tactical transport for the French air force and the choice was narrowed down to the Breguet 945 (illustrated here with its civil predecessor, the 941), the Dassault Super Communauté and the Nord-Holste Super Broussard. Both the last two are to be powered by two Turboméca Bastan turboprops giving 1,080 h.p. each, while the 945 will have two Turmo IIIDs, giving 1,300 h.p. and driving four 12.5ft Ratier propellers on a common transverse shaft. The power of the Turmo may be increased to 1,500 h.p. eventually.

The Super Broussard, possibly designated MH.270, will differ little from the civil MH.260, except in having clam-shell rear-loading doors. The fuselage is already large enough to accommodate two jeeps although the specification is reported to call for only one. The 1,080 h.p. Bastans should somewhat improve an already excellent field performance—balanced field length of 3,280ft at maximum gross weight of 21,583lb at sea-level in ISA. Landing distance from 50ft is given as 1,575ft and a maximum payload of 8,851lb could be carried for 390 statute miles. Quoted range with full fuel is 1,012 statute miles.



Artist's impressions of the Breguet 945 STOL transport, in which four propellers are driven by two turboprops and spanwise shafting



Progress with the first Breguet 941 is illustrated by these photographs of the fuselage of the first flight specimen. Considerably larger than the 945, the first 941 should fly in time to perform at the Paris Salon

The Super Communauté is reported to be 40 per cent larger than the prototype now flying and to have developed high-lift devices. The manufacturers claim a field length of 980ft at 3,280ft altitude in 40°C, with extensive flap-blowing.

The Communauté and its armed derivative, the Spirale, were developed principally for military service, but the Super Broussard, now produced and marketed as a joint venture by Nord and Holste, already has French government backing for an initial batch of 100 offered to civil operators. A pre-production batch of five is being built and the prototype has already completed well over 100hr of successful test flying.

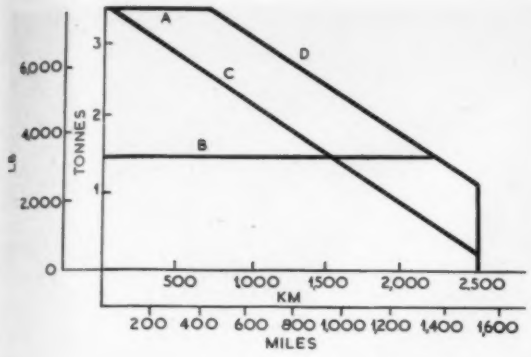
Technically the most interesting of the three, and one which has a very good chance of winning the competition, is the Breguet "blown wing" STOL 945. Accompanying pictures show the fuselage of the 941, a larger machine, nearing completion. It is scheduled to fly in time to be demonstrated at the forthcoming Salon at Paris in June and should prove one of the main attractions. The French Aéropostale service and BEA, as well as several other companies and countries have already shown considerable interest.

The 945 is generally a scaled-down version with only two engines, but retaining the double-flap high-lift system, the Messier Jockey undercarriage and rear-loading doors. The nose has exten-

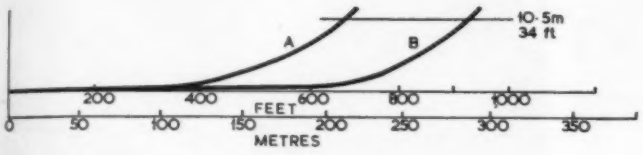
STOL Competitors*

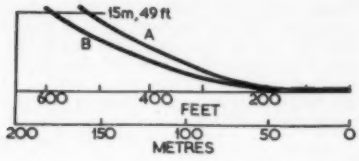
	Breguet 945	Dassault S. Communauté	MH Super Broussard
Powerplants (2)	Turmo IIID, 1,300 h.p.	Bastan 1,080	Bastan 1,080
Span	66ft 9in	54+	71ft 8in
Length	54ft 5in	43+	58ft 1in
Cabin length (ft) ...	22	22	21
Cabin width (in)... ...	76	71	86
Cabin height (in) ...	73	55	79
Max payload (lb) ...	see graph	3,000+	8,851
Gross weight (lb) ...	22,000	15,000+	21,600
Field length, i.s.a., s-l. (ft)	see graphs	under 1,000	2,500?
Max cruise (m.p.h.) ...	248	300+	235+
Min speed (m.p.h.) ...	49	70?	56

* These data are all to be regarded as provisional.



A pleasing study of the Max Holste Super Broussard, which has completed a major part of its test-flying since it flew last July





Makers' performance curves for the Breguet 945. Above, left, is a payload/range plot: A, manœuvring factor 2.5; B, manœuvring factor 3.5; C, take-off weight 10 tonnes (22,050lb); D, take-off weight 11 tonnes. The lower diagrams are for take-off (left) and landing, letters A and B respectively representing sea level at 15°C and 1,000m (3,280ft) altitude at 40°C

sive windows and some illustrations have shown an armed version with heavy-calibre machine guns mounted in the nose and in doorways, as well as rocket pods and missiles.

The graphs above clearly illustrate the remarkable slow-flying performance of this machine. It can fly at 45kt and make turns of as little as 80yd radius—such performance has indeed already been demonstrated by the prototype 940. Breguet claim with some justification that the performance of this series of blown-wing transports is equivalent to that of presently available cargo helicopters. They also claim four safety factors in the basic layout. The failure of one engine on take-off has no asymmetric-power effects and less than half power is lost because the propellers work more efficiently under the lower load. The descent gradient during the approach can be up to four times steeper than that of a conventional aircraft, rendering obstacle clearance much easier. Full power can be very rapidly applied in reverse thrust to shorten the landing run, even on slippery ground. Because each approach is made with power, an overshoot can be more quickly initiated and involves only a change in propeller pitch. The flaps can be immediately retracted to reduce drag.

The 945 can also operate as a conventional aircraft, without full slipstream deflection, and its permissible gross weight can then be increased to 26,400lb, with consequent improvement in payload and range.

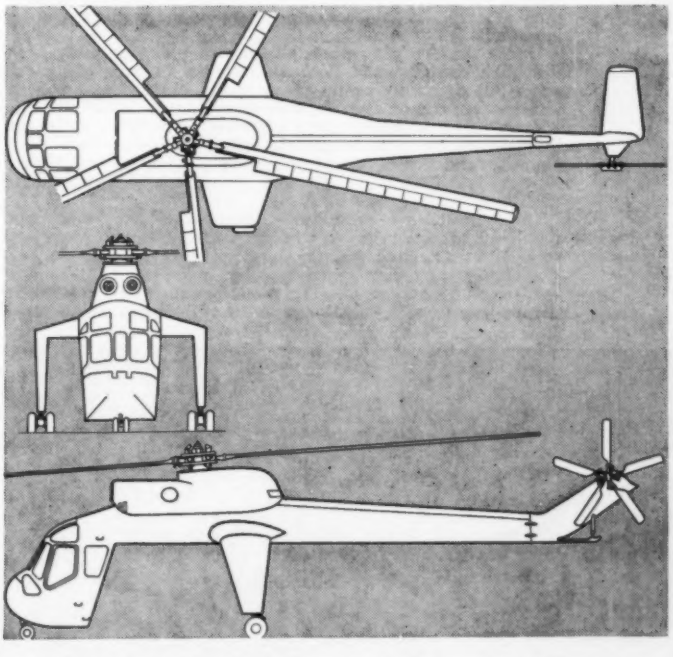
SIKORSKY'S UTV

THE above account of French STOL aeroplanes is illustrative of the manner in which such machines are encroaching upon the domain of the helicopter. Aware of this fact, Sikorsky are making a sustained effort to produce better helicopters. Around the formula of a single, multi-blade lifting rotor, shaft-driven by turbines, they are developing a series of excellent vehicles, most of which have an amphibious hull of flying-boat form. Their lift and propulsion systems have been used as the basis for a series of "cranes," intended to lift and place loads over relatively short ranges—possibly no more than a few yards.

Flight experience has already been gained with the S-60 crane, derived from the S-56. Its turbine counterpart is the impressive S-64, projected with twin GE T64 or P & W JTF-12 engines. Now Sikorsky have announced a smaller crane, to which we referred in a leading article last week: the UTV, or Universal Tactical Vehicle.

In general, the members of United Aircraft Corp are conservative, and Sikorsky's choice of so pretentious a name for this new crane suggests that they feel it should be the right answer for some years to come. Its dynamic components are those of the US Navy's HSS-2, the combat counterpart of the S-61L illustrated on page 33 of our January 6 issue. Twin GE T58-6 engines, each rated at 1,050 s.h.p., drive a five-blade 62ft main rotor; gross weight of the HSS-2 is classified, but the S-61L weighs 18,700lb.

In their 1961 calendar Sikorsky depict the UTV in several roles. Some of these require the powerful winch in line with the rotor axis, and in all cases the co-pilot can swivel his seat through 180° to face a duplicate set of flight controls and rear-facing windows. The suggested missions are: passenger or troop transport, with approximately 20 seats; ASW, carrying a pod housing a sonar, weapons and two operators; cargo transport, on a suspended pallet; emergency dispensary, the pod housing a field hospital; missile transport, tactical weapons being carried on their launchers; mobile machine shop (a role in which the UTV's lifting ability might be useful in rescue or salvage operations); weapons transport; rescue, survivors from any catastrophe being winched directly into a medical capsule; mine countermeasures, with a special sweeping pod; tanker, with a palletized bag; power package, carrying an electric generator; and radar outpost, built up from integrated pods. Tantalizingly few details of the UTV are available, but indicative of its lifting ability is the fact that the useful load of the S-61L is 9,430lb out of a gross weight of 18,700lb. Sikorsky may price the UTV at about $600,000.



These photographs taken at Boeing's Wichita plant appear to show a version of Skybolt earlier than that illustrated on page 44 last week. On the right is the mock-up of the B-52H installation discussed on this page; above is part of the aircraft itself, showing the difference in chord between the two sets of Skybolt fins, and what appear to be star-trackers immediately ahead of the pylon fairings. The nosecones appear to have an included angle midway between those on the right and those illustrated last week

Missiles and Spaceflight

SKYBOLT'S CONFIGURATION

On page 44 last week we reproduced a photograph, taken in Boeing's Wichita plant, illustrating the mock-up of the port twin-Skybolt installation beneath the port wing of the B-52H. The picture had been radioed, and was thus of comparatively poor quality. We have since received a USAF photograph, released by the Department of Defense, of much superior quality, and it is reproduced on the right above.

Less obvious than the fact the two photographs are taken from slightly different viewpoints is the conclusion that they actually show different development stages, reflected in superficial changes in the missile's appearance.

Oddly, the new picture was almost certainly taken *earlier* than that published last week. Each nosecone has an included angle of about 30° and a tip radius of about 6in. Both first-stage and second-stage motor cases have sections in which the diameter appears to be approximately 1in greater, and both sections are bridged by instrumentation fairings. The rear of the missile body seems to terminate in an ogive fairing of the type predicted in our drawing of November 4 last, and around it are disposed eight delta fins, four large and four small.

In contrast, the presumably more up-to-date photograph published last week showed a re-entry vehicle with a nosecone of some 70°, tip radius remaining about the same. The parallel portion of re-entry vehicle appeared to be longer, possibly to accommodate a larger warhead. The re-entry vehicle of the outboard missile bore stencilled markings which might represent aerials or windows for sensing systems. In spite of heavy retouching it was possible to see that the variation in case diameter was still present, although the instrumentation fairings had disappeared. The tail fairing likewise appeared to be absent, and the four larger fins had been cropped to have axial tips. An access panel had been cut in the underside of the horizontal pylon structure. It could also be noted that the mock-up room had been properly furnished, in contrast to the draped sheets (for security purposes) seen in the newer-but-older picture on this page.

Two Convair F-106B aircraft are now used by the seven US Project Mercury astronauts to keep in current flying practice. From the left are astronauts Scott Carpenter, Gordon Cooper, John Glenn, Virgil Grissom, Walter Schirra, Alan Shepard and Donald Slayton

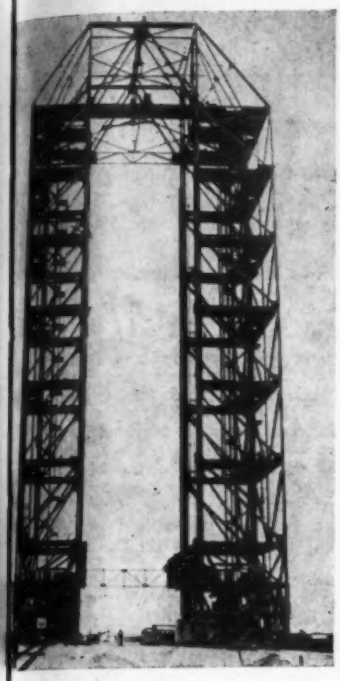
NEW BRITISH MISSILES

Special attention may be paid to the reference to "new weapons for defence against low-flying aircraft" in the statement issued in Bonn and referred to opposite. According to the Defence Correspondent of the London *Daily Telegraph* "The communique's reference . . . implies, I understand, joint development of the new British short-range anti-aircraft missile now designated PT 428. This is for use by troops in the field." No such weapon has been announced, and the newspaper's source may well have been a story which appeared in the London *Daily Express* last November 25. In part, this ran: "A new anti-aircraft guided missile for dealing with supersonic bombers which sneak in at tree-top height is to be made by the English Electric Company. The missile, known as Project 428, will snap at enemy planes as they come low over the skyline in the way a sportsman shoots at grouse. And it will automatically launch itself as soon as its radar picks up a target. The Government is giving it top priority because it might be adopted as the low-level anti-aircraft missile throughout NATO."

If the report is correct it will give the British Aircraft Corporation, of which English Electric is a member, a further lead in missile development. Another of the group's major projects is the corps-support (tactical ballistic) weapon Blue Water, which seems to be regarded so seriously by its American competitors that the January 9 issue of *Newsweek* claims that it "may join the ill-fated Blue Streak in the ash-can" and suggests Britain may buy the American Sergeant instead. This contention appears to be based on the hope either that Blue Water will run into severe development difficulties or that it can be bulldozed out of the way by political pressure.

CANADIAN RE-ENTRY STUDIES

A one-year operation involving an RCAF and Canadian Defence Research Board unit based on Ascension Island and engaged in recording ultra-violet, visible and infra-red radiations from



Tallest tower at the Cape: no less than 310ft high, this service tower will be used for the testing of the 1.5 million pounds thrust Saturn rocket at Cape Canaveral, Florida

re-entering nosecones was completed last month. Known as Operation Lookout and conducted in association with the US Advanced Research Projects Agency, the work involved two CF-100 aircraft fitted with special wing-pod instruments designed by the Canadian Armament Research and Development Establishment.

The nosecones under investigation were those of missiles launched down the Atlantic Missile Range from Cape Canaveral. The mission of the CF-100s was, in effect, to photograph the nosecones as they re-entered the dense layers of the atmosphere. After preliminary on-the-spot examination, the records obtained were sent to the Research and Development Centre for analysis. Valuable data were obtained on 90 per cent of the missions flown. At Ascension Island the project scientist was Dr Guy Giroux and the air detachment was commanded by Flt Lt Murray Sweetman; while Dr Cameron Cumming was programme scientist at CARDE.

EUROPEAN PROGRAMME COSTS

Speaking in Copenhagen on January 13, the Minister of Aviation, Mr Peter Thorneycroft, said that the total cost of the proposed European space programme would be about £70 million over five years. The proposed Danish share of this was about £1.5m. He said that it was intended to operate the project with a policy committee based in continental Europe and a technical executive committee in London.

The Minister also said: "The opportunity is there now. Europe cannot come back in five years and regret not taking the chance. It will be too late then."

FRENCH/US JOINT SATELLITE

Negotiations are under way between the US National Aeronautics and Space Administration and the French Commission for Spatial and Scientific Research aimed at a joint scientific satellite programme similar to that already agreed between the USA and Britain. Talks have been held in Paris and in Washington, but the discussions have reached only a preliminary stage at present.

SEACATS FOR GERMANY

After a series of negotiations lasting almost 30 months, it was finally announced in Bonn on January 11 that the Federal German Government will purchase an evaluation and trials quantity of Seacat surface-to-air missiles. The final series of talks—which also embraced the Hawker P.1127, as noted on page 72—involved Mr Peter Thorneycroft, Minister of Aviation; Sir Christopher Steel, our ambassador; Sir Steuart Mitchell, controller, guided weapons and electronics, MoA; and Mr Dennis Haviland, a deputy under-secretary, MoA. On the German side were Dr Volkmar Hopf, a state secretary in the Defence Ministry; Gen Heusinger, chief of staff of the Bundeswehr; Lt-Gen Kammhuber, Luftwaffe chief of staff; and Dr Theodor Benecke, German delegate to Agard; Defence Minister Strauss was indisposed.

In a statement issued late on January 11 it was stated that "The Governments of the United Kingdom and the Federal German Republic hold the same views on new weapons for defence against low-flying aircraft. The British Government intend to expand the tripartite co-operation existing in this field between France, Italy, and the Federal Republic, by participating in this joint effort and thus giving it a broader basis" [this statement is commented upon in the news item "New British Missiles."—Ed].

Seacats have already been sold to Australia, New Zealand and Sweden, and several other countries appreciate that it is the only guided weapon which they could economically purchase and fit into existing vessels. In the case of Germany, however, the Seacats are not for existing craft, but for multi-purpose ships of which even the design is still not finalized. The Brussels Treaty limits German naval craft to 3,000 tons, but the Federal Government has announced its desire to build a class of 6,000-ton ships for use against submarines and aircraft. Seacat would be partnered by a larger missile as primary armament.

NEW SATELLITE-TRACKING CAMERA

A high-performance camera for recording satellite positions is being developed by the Royal Radar Establishment, Malvern. On view in model and diagram form at the Physical Society Exhibition in London this week, the new instrument will employ a Schmidt optical system of 24in aperture and 24in focal length, and will have a flat field of approximately 10° × 7°.

The large aperture of the system, and its high optical quality, should enable satellites of ninth or tenth magnitude to be recorded. Absolute accuracy in position is estimated as ±2sec of arc but, by "smoothing" the measurements from a number of positions, a relative accuracy of ±0.25sec should be obtained. Absolute accuracy in time depends on the accuracy with which GMT is measured, but relative accuracy is ± 0.1 millisec.

Also shown at the exhibition was an RRE camera which has been regularly used for satellite tracking. With a 36in focal length and 6in aperture, this instrument has a field of 14° × 14°. On a recorded satellite track of good quality, individual positions should be obtained to ±3sec of arc with a timing accuracy of 1 millisec. Smoothing the measurements gives an accuracy better than 1sec of arc. Sensitivity of the camera is limited by the aperture, and only satellites of fourth or fifth magnitude, or better, can be recorded.

"Two Polaris submarines now are stationed in the Atlantic and each stays there for 60 or more days at a time," according to Rear Admiral Charles B. Martell of the Office of the Chief of US Naval Operations, speaking on January 12.

Admiral Martell called the Moon "the most reliable satellite" and said that the US Navy used it regularly for communications between Washington and Honolulu. "Recently there was a solar storm of such intensity," he said, "that communications via the Moon were the only thing available between the two points."

A Nike-Cajun two-stage sounding rocket was fired from the Italian Air Force base at Rerdasdefogu, Sardinia, to a height of about 105 miles on the night of January 12-13. This was the first launching in a co-operative research programme in association with the US National Aeronautics and Space Administration.

On the night of January 13 "an object with missile characteristics coming out of Russia which might be either a space shot or a rocket fired into Russia's Pacific testing range" was detected by a USAF radar station on Shemya Island, off the coast of Alaska. The object was tracked for six minutes on a south-easterly heading.

According to our American contemporary *Missiles and Rockets*, one division of the Belgian army is to be equipped with the Entac wire-guided anti-tank missile. Developed by the French national DEFA establishment, Entac was described in our November 4 issue.

On January 12 a B-52G made a 6hr flight from Wichita carrying four dummy Skybolts. The mock-ups were aerodynamically and ballistically correct, and are being used to prove the stresses experienced by the pylon, which is fully instrumented. On the opposite page will be found a photograph of dummy missiles on the first B-52H.

The US Army announced on January 9 that Northrop's Radioplane Division had been awarded a second contract for RP-76 target drones; 770 are being bought, the first contract having been for 700, as outlined in our December 23 issue. Recently an RP-76 travelling at M1.15 at 55,000ft was hit by a Nike-Hercules at McGregor Range. Both height and speed are a record for an Army battery during annual service practice.

The US Navy is giving some thought to using low-frequency radio transmissions from a space vehicle to communicate with its submarines while they are under water. Low-frequency radio based on the shore has been employed to communicate with submarines while they are under water and the results are encouraging, although great transmitting power is required. A satellite with very long, streaming antennae might be used.

On January 10 a Polaris A-2 was successfully fired approximately 1,600 miles down the Atlantic Missile Range from a shore pad at Cape Canaveral. Design range is 1,500 n.m., and the 30ft 6in missile is scheduled to become operational next year. Conversely, a Polaris A-1 failed after a satisfactory underwater launch from the *Robert E. Lee* on the following day. After correctly starting its 1,100-mile trajectory, it suddenly turned downwards while under first-stage power, and was destroyed in flight by the range safety officer at Cape Canaveral.

Following negotiations between the US State Department and British Government, it has been announced in Washington that American ASW systems are to be developed at an underwater range to be constructed off the Bahamas. To be known as Autec (Atlantic Underwater Testing and Evaluation Centre), the new facility will cost some $100m (£35.7m). It will include a land base on Great Exuma, which was one of the areas leased from Britain for 99 years in 1940 in exchange for American destroyers. Autec will include facilities for various detection, tracking and communications systems, and for the complete evaluation of the ASW missile. The most advanced such weapon is Subroc, which has a range too great for any existing underwater range.

Missiles and Spaceflight . . .

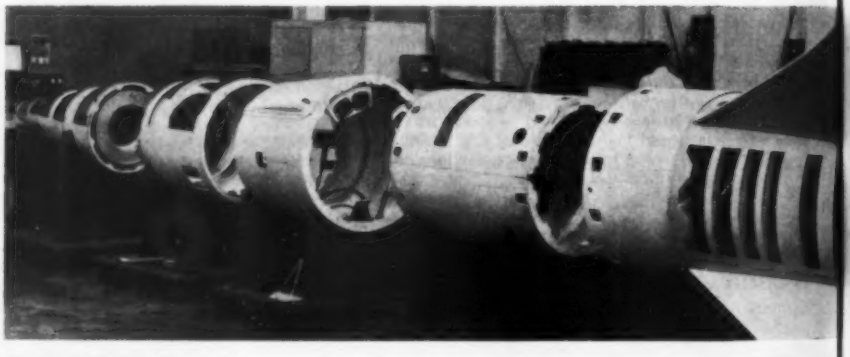
A research and development Nike-Zeus being mated to its booster on the rail-type launcher at White Sands, New Mexico. Boost thrust is 450,000lb

DEVELOPING ZEUS

During the past five years it has become increasingly clear that, although it suffers from a number of severe disadvantages—chief of which are probably its limitation in slant range and ability to discriminate between target and decoys—the Nike-Zeus weapon system is the only one in the West which shows promise of being able to destroy an ICBM re-entry vehicle. Under the management of the US Army Rocket and Guided Missile Agency, Zeus is being developed by an Army/industry joint team based upon that which produced the earlier Nike-Ajax and Nike-Hercules. Prime contractor is Western Electric, and major subcontracts are held by Bell Telephone Laboratories, RCA, Sperry, Thiokol and Grand Central Rocket Co. Airframes are manufactured by Douglas Aircraft at Charlotte, NC, and at El Segundo, Cal. Substantial funding during the past three years, including a $200m (£71.3m) award last September, is maintaining the development effort at the very high level commensurate with the magnitude of the task, but a decision on the future of the system is fast becoming critical. According to our American contemporary *Aviation Week*, Western Electric have said unless limited production is authorized they will be forced to reduce the size of their Zeus team. It is averred that a decision one way or the other must be taken this month.

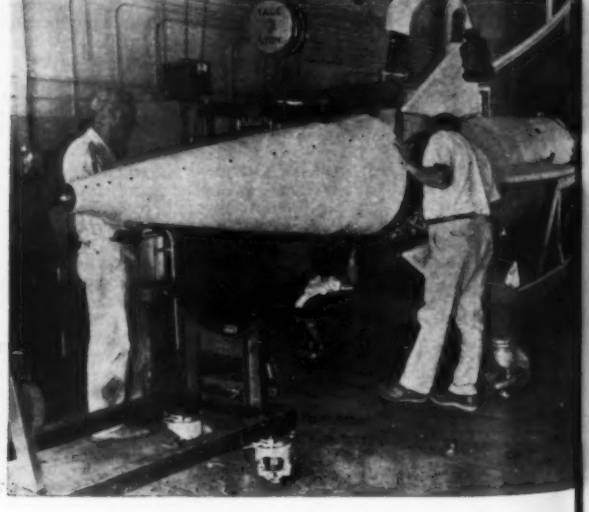
Reports on Zeus appeared in *Flight* for January 1, May 20 and November 4 last year, and last week we published a photograph of the most recent of the 12 test vehicles to have been fired at White Sands, New Mexico. It is now possible to publish photographs showing research and development work in progress. A clue to the disposition of major components is provided by the picture of the mock-up missile body. The latter is seen to be divided into about seven distinct sections (some seem to be missing), each assembled and functionally tested as a separate entity, mating of the sections taking place shortly before firing.

Another photograph depicts assembly of the warhead of a real R & D missile at White Sands. In another picture the nuclear warhead assembly and control system is pictured at El Segundo undergoing tests on a large vibration generator mounted horizontally. Flight testing has so far gone relatively well. Guided flights have been made from White Sands, full-range tests of representative operational missiles is shortly to begin at Point Mugu, and the complete weapon system is expected to be tested in about a year's time against Atlas re-entry vehicles fired down the Pacific Missile Range. The Zeus missiles will be based at Kwajalein, in the Pacific Marshall group, about 5,000 miles west of the ICBM launch point at Vandenberg.



A mock-up of major components of the Zeus airframe, most of which is manufactured by Douglas Aircraft. Inspection suggests that two portions are missing in this photograph, one being the sustainer forward section and the other being the warhead and control fins

Below, vibration testing a Zeus warhead and forebody at Douglas El Segundo (left), and assembling a research and development round at White Sands



Air Law versus Science

NEW THOUGHTS ON TRADITIONAL IDEAS IN CAPLAN LECTURE

ENTITLED "The Law versus Science in Aeronautics. An Essay in their Mutual Impact and Interaction," a thought-provoking paper was presented before the Royal Aeronautical Society on January 12 by Mr Harold Caplan, DCAe, AFRAeS, AMIMechE, assistant secretary of British Aviation Insurance Co Ltd. Extracts from this wide-ranging study covering subjects as diverse as supersonic transports and space exploration are printed here: the lecturer covered in addition examples of early aeronautical legislation abroad and in Britain, legal "drag" as an operational parameter (including restrictions on scheduled and non-scheduled services, and documentation), and scientific causation versus legal liability.

THIS paper is designed to persuade members of the Royal Aeronautical Society that they have a vital part to play in moulding the future laws of aeronautics. The practice of law is very properly left to lawyers, and this paper will be of little interest to the professional lawyer. It attempts to be neither scholarly nor objective. It is a ruthlessly personal plea to the Society to find ways of harnessing the scientific method in the service of aeronautical law-making, based on the conviction that, unless this is done, aeronautical activity will remain a blind technological tool of an imperfect civilization . . .

As in school exercises, the task will be to "compare and contrast" the separate disciplines of *law* (man-made rules for men) and *science* (man-discovered rules for man and the universe). In essence therefore this is a study of the contrast between the laws of man and the laws of nature—a conflict familiar throughout human history.

It is first essential to realize that the rules of law are not necessarily logical. The state of the law at any given moment is the result of fitting together the multiple accretions of human rule-making—some of it in one century, some of it may be in another. Although the process of fitting the rules together may be logical, since the rules are not necessarily compatible one with the other, the result may often lack logic . . .

Scientific or technical knowledge, on the other hand, must have a logical structure. Its hypotheses must be capable of being tested by observation or experiment. An hypothesis only has value so long as it is consistent with all available evidence and can be used as a basis for prediction.

Thus the law may be in a constant state of evolution towards the desirable regulation of human conduct as society sees it from time to time. At the basis of law is therefore human will and consent and it may represent a society's summation of scientific, political, economic and humane aspiration at any given moment.

The laws which science seeks to unravel are unalterable by human will or consent, and progress is marked by better and better approximations to the underlying rules of the natural universe . . .

The way in which the scientific knowledge of an age gradually permeates to the level of everyday knowledge and awareness is not usually in the form of scientific theories, but more often in an acceptance of the technological applications of science for everyday use. Thus the ubiquitous "man-in-the-street" need know nothing about aerodynamics, but he is content that an aeroplane is a man-made device and is not supernatural. This diffusion of science down to an everyday level then becomes part of his background of thought—which then must colour any consent which he gives to the society in which he lives. Since consent is at the basis of national and international law, it may be seen that there has been an *interaction* between science and the law throughout history . . .

Supersonic Aircraft It is generally recognized that each nation today has its own airlines largely for reasons of "diplomatic prestige, national pride and strategic position." If the Mach 2 or 3 airliner is pressed into airline service then the size of the anticipated capital investment is such that only a very few routes, such as the North Atlantic, are likely to be operated by single airlines owning their own supersonic craft. Elsewhere—for example in Europe—there is every likelihood that supersonic aircraft will be jointly owned and operated by several airlines of different nationalities. The Scandinavian Airlines System, Air Union and other linkages are likely to prove even more popular in the future, not only as a means of providing capital but, more important still, the pooling of traffic rights (as distinct from the pooling of operating revenue, which merely reduces competition).

Aircraft may only be validly registered in *one* State, and each State generally requires that registration be confined to the legal or beneficial interests of its own nationals or firms registered for business purposes in their territory. Governments of the future will *have* to make allowance for a sharp separation between legal ownership, beneficial ownership, rights of possession and use—and all on *international* bases rather than national bases. The United Kingdom is already prepared to register aircraft if they are merely chartered to (rather than owned by) qualified persons. Even greater concessions may be necessary over the next 20 years.

One of the most significant legal and practical consequences of cruising at Mach 2 or 3 will be the shockwaves generated by the aircraft cutting a broad swathe through the countryside with a crack of doom. It is not yet clear whether there will be a close correlation between the altitude necessary to reduce ground pressure waves to acceptable levels and the altitude necessary for reasons of operational economy. If these altitudes turn out to be very different from each other, then the other alternative will be route deviations—again unattractive economically.

In the United Kingdom there is little doubt that the registered owner of a supersonic aircraft would be absolutely liable for damage done by the shockwaves irrespective of negligence. But the minimum height for such aircraft is not likely to be much less than 50,000ft. How can they possibly be identified at such heights? Small errors in altitude or routing can create havoc in terms of nuisance, even if not in terms of physical damage.

If it proves impossible to identify the culprits as a matter of course then action will be needed to deal justly with the suffering of innocent, ear-shattered citizens. Supersonic aircraft operators may perhaps be asked to contribute to a joint fund for the study of these problems and the provision of compensation for those who may be uninsured for such losses. It may be too early to decide whether the contributors should be governments or airlines or both. The only thing certain is that solutions must be found within the foreseeable future, otherwise public opinion alone may act as a powerful inhibiting influence on the use of supersonic monsters. ICAO has scarcely got this task on its worksheet . . .

Out in Space International law is a description of the nature and operation of common consent between sovereign nations. In the work of describing and analysing the structure of international law, jurists work logically using a "scientific method" very much in the same way as scientists or engineers would do. But there the resemblance to the work of science stops.

For when jurists attempt to predict the future practice of international law they are continually apt to be frustrated by the waywardness of the sovereign nations which they study. The fault lies not in the legal method but in the freedom of action which is possible to a sovereign power . . .

In areas where there is as yet no discernible structure of law—for example, in the voids of interstellar space—every man on Earth may be entitled to say what he would like the rules to be. The opinions of eminent jurists undoubtedly influence the official policy of the sovereign nations, and hence for some years writers have been discussing real and imaginary problems in the law of space.

To professional soldiers, the notion that war is a "great game" or a sacred duty dies hard. From the beginning, the possibilities of aerial warfare have shaped the foundations of international air law, and men of peace (including lawyers) have fervently addressed themselves to the task of consecrating airspace and outer space for peaceful purposes. There is a superstition that, if everyone talks about the peaceful use of space often enough and long enough, this will ensure that space will rejoice in peace.

Because the 1944 Chicago Convention and the USSR define sovereignty in terms of "airspace," argument rages over how high this extends. Lawyers argue that they need only discover the physical extent of the atmosphere to discover the limits of national sovereignty. Others assert that sovereignty should be defined in terms of the transition from aerodynamic lift to ballistic orbit. No matter how correct these approaches may be from the point of view of legal theory, they will surely strike our descendants as being childish games of a most appealing naïveté.

No matter how sophisticated the arguments about national sovereignty, it should not be forgotten that individual national sovereignty itself is an ancient concept which may not survive the twentieth century despite the present booming birth-rate of new nations. The increasing economic interdependence of nations, the "explosion" of world population and the abuse of sovereign power

may ultimately lead to a dismantling of the extreme apparatus of individual sovereign power.

The essential activities which are in need of regulation are still human activities. We cannot pretend to legislate for any other Intelligences who may be roaming through the universe. Therefore there is no need to postulate a new regime of law merely because we are able, for the first time, to poke through the thin layers of gas which cover the Earth, nor need we establish a novel legal system for vehicles because they have rocket motors or can be steered beyond the Moon . . .

That is not to say that there are no problems to be solved: there are many, but they are mostly of a familiar kind. For example, the United Nations Ad Hoc Committee on the Peaceful Uses of Outer Space has made several suggestions for immediate work: (1) The allocation of radio frequencies for space vehicles (this has already been commenced); (2) Liability for injury or damage caused by space vehicles; (3) Avoidance of interference between space vehicles and aircraft; (4) Identification and registration of space vehicles and the co-ordination of launchings; and (5) Permission of subjacent states for re-entry and landing of space vehicles in the airspace.

Topic No 2 above is the only truly legal problem involved and can be tackled by a suitable extension of the scope and provisions of the 1952 Rome "Convention on damage caused by foreign aircraft to third parties on the surface." Topic No 5 can only be worked out in detail when there is substantial agreement on the other problems. *All the other immediate problems are essentially technical or scientific ones*, and scientists should lose no time in addressing their minds to this task.

The International Astronautical Federation is to be commended upon its initiative in this field but so far appears to have designated lawyers alone for these tasks. No doubt the individual lawyers will collaborate with their scientific colleagues, but it would have been better if the various working groups had a predominantly scientific composition with, perhaps, a legal chairman. Unfortunately many of the American lawyers associated with the IAF, and led mainly by the eminent legal scholar Prof J. C. Cooper, still regard the definition of sovereignty and the regime of "space law" as of paramount importance.

National sovereignty should be left where it is—a creation of the essentially earthbound past: a monument to the horizontal limit of the imagination of statesmen. Strict ideas of national sovereignty have not prevented the USA and Canada from establishing identification zones for approaching aircraft which extend hundreds of miles over the high seas where no nation has sovereign power . . .

Example of the IGY

Satellites, ICBMs, Moon and Sun probes have all been launched without any significant squeals of anguished sovereignty. In fact the pattern of the IGY scientific collaboration, whereby the co-operating nations gave their tacit consent to satellite launchings, is a very good indication that, if the scientific problems are solved by scientists, national sovereignty can be quietly laid to rest. Determined work on the minimum necessary rules for the conduct of space activities can take place immediately . . .

No major problems will be reached until it is necessary to consider landings on, and occupation of, extra-terrestrial bodies such as the Moon. Again we have an earthly precedent: on December 1, 1959, twelve nations (including the UK, USA and USSR) signed a treaty dealing with Antarctica, describing the *peaceful* scientific activities which might be carried on there and, more important still, *suspending* any claims to sovereignty . . .

A similar treaty will be necessary to deal with all natural extra-terrestrial bodies, but it will be important not merely to *suspend* sovereignty claims (for that implies that sovereignty can be resumed) but to announce expressly that no nation is making any claim to sovereignty. It may be too much to hope that *all* the nations could agree to *renounce* all claims to sovereignty outside the Earth. But the existence of a modified Antarctic treaty would ensure that, with the passage of time, earthly sovereignty would wither as a concept for extra-terrestrial extrapolation.

The USSR, which claims to have hit the Moon's surface with a Soviet pennant, expressly disavowed any accompanying claims of sovereignty. Lord Hailsham, for the United Kingdom, has *renounced* any UK claims to sovereignty on the Moon. Although cynics may declare that this is merely a declaration of impotence, it is to be hoped that the wisdom and restraint of the UK and the USSR may be continued by all nations.

Why has the USA been reluctant to follow suit? There can be little doubt that their underlying caution is dictated by a desire to preserve the inherent right of all nations to defend themselves in the event of attack (Article 51 of the United Nations Charter). Nevertheless, a staff report submitted to the US House of Representatives contains some of the most sober advice available so far on how to tackle coming problems. For example, the report recommends that the development of rudimentary space law should proceed by agreeing only *principles* initially in the most urgent and fruitful areas, and that this may be done by emphasizing "agreements on scientific and commercial uses of space, working from there toward the larger issues such as national sovereignty."

War exists in the minds of men on Earth and no nation with warlike intentions will be inhibited by agreements on the peaceful use of either the Antarctic or outer space. History may very well show that the use of words like "peaceful" and the concept of "space" as a separate region of law are simply acts of unsuspecting international self-deception.

This is the golden age of space lawyers and may be compared to the discussions on "freedom of the air" which preceded the Paris Meetings of 1910 and 1919—all of which were marked by a vivid apprehension of the air as yet another frontier to defend.

Undoubtedly the combined efforts of the world's lawyers, politicians and scientists may be necessary to enjoy the age of exploration beyond the Earth. The noble richness of each writer's dreams of Utopia in space is symbolic of discontent with affairs on the Earth: at the worst this may be no more than individual catharsis; at the best it may be capable of fulfilment. The essential evil of war remains to be conquered on Earth, whether it is waged with the Roman short "sword of courage" or X-bombs from space.

General Conclusions After such a widely-ranging discussion it is tempting to emerge with some impressive principles for the guidance of mankind. The views which follow are the result of an unsuccessful battle with temptation, but they are offered in the full knowledge of their human frailty, incompleteness and arrogance, in the hope that they may suggest stimulating lines of thought to other members of the Royal Aeronautical Society:—

1. Traditionally there has been little opportunity for direct consultation with scientists in the evolution of law.
2. In aeronautics this has had the result that the rules of law can often act as a serious limiting operational parameter—particularly for supersonic aircraft.
3. In aviation accidents, the operation of rules relating to legal liability can often throw a financial responsibility on to sections of the community which may be blameless from a scientific point of view.
4. Unless changes can be made in the laws associated with aeronautical activities, many scientific members of this Society may find their future livelihoods at stake.
5. Scientific "operational research" could usefully be applied to the evolution of future aeronautical law.
6. Detailed rules governing aeronautics should not be mere catalogues of prohibited evils from the past, but should positively encourage a rational approach to the conduct of aeronautics.
7. For example, infringement of aeronautical rules should not necessarily be a crime, unless the delinquent failed to undertake further education and training. Those who failed appropriate tests, or persistent offenders, would be merely excluded from activities in any branch of aeronautics for which they were found unsuitable (subject to the normal penalties).
8. Lawyers are at their best in describing and analysing the state of the law, in the weighing of evidence and in the fight for the preservation of essential human liberties and dignities.
9. To avoid strangling the future of aeronautics with the noose of ancient thought embodied in our law, scientists, lawyers and law-makers must find ways of collaborating effectively to identify essential problems and evolve creative solutions.
10. Failure to do this may have the gravest consequences when preparing the way for explorations beyond the Earth.

From all the above, one single practical suggestion is made for the consideration of the Royal Aeronautical Society:—

"That this Society should promote and establish (either within the Society or outside it) a Law Reform Committee with the general duty of applying aeronautical and other allied sciences to the evolution of law."

There are already in existence many groups representative of sectional interests—e.g. the Armed Forces, or the British Independent Air Transport Association—who are able to present their particular viewpoint effectively. Members of this Society, in their capacity as members of a learned society, have no similar opportunity.

The chairman of such a committee should be legally qualified and appointed, say, from the panel of lawyers accustomed to conducting public inquiries into aircraft accidents. The maximum number of members is probably best confined to six: four scientists, two of whom should have senior high standing in research or the universities, the other two being younger men (not exceeding 40!); and two lawyers, at least one of whom should already have some acquaintance with aeronautics.

This suggestion may cause difficulties in the status of the Society, its rules and liability to tax and rates. But if the idea is worth pursuing, then the difficulties are there to be solved, not relied upon.

FLIGHT COPYRIGHT

Airliner Census

JANUARY 1961

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THIS is the fourth *Flight* Airliner Census, in which an attempt has been made to list every transport aeroplane in airline service throughout the world excluding the USSR and China. It is an extensive revision of the last edition published on October 2, 1959, and a great effort has been made to maintain a high standard of accuracy. Perfection in such a compilation as this is unattainable, however, and we hope that users of this work will continue—as they have kindly done in the past—to suggest deletion and additions.

The same method of presentation as before has been adhered to: the aircraft are listed according to the nationality of their manufacturer, and each column has regional sub-divisions to make reference and identification as easy as possible. A question mark against the name of an airline means that the number of aircraft owned is not known. The letters (FS) after a number indicate that the aircraft in question are known to be up for sale, while the letter (L) after a number indicates that the aircraft in question are leased to the carrier, usually by another airline (e.g., Swissair's Caravelles are leased from SAS). Where aircraft have been modified to a later model—e.g., Convair 340s to 440s—they are listed under their original type. Figures in parentheses refer to aircraft on order but not yet delivered.

UNITED KINGDOM

N. and S. America	Europe	Mid-East and Africa	Asia and Australasia
AIRSPEED (now DE HAVILLAND)			
AMBASSADOR: No built 21, in airline service 14.			
	Globe Air 1 BEA 6* BKS 4 Dan-Air 3 14		
* In storage			
AVRO			
ANSON/AVRO XIX: No built 11,020, in airline service 44.			
Austin 3 Canadian Nickel 1 Chinook 1 Halls Air Service 1 Ilford 1 Leavens 1 Pac. Western 5 Trans-Air 2 15	Air Navigation & Trading 1 BKS Air Survey 2 Derby 2 5	C.G.T. en Algerie 1 1	Nanyang 3 Brain & Brown 1 Carsair 4 Crowley 1 Flinders Is. 3 Marshall 2 MMA 1 Papuan 2 Robby's 1 Southern Scenic 3 Woods 2 23
YORK: No built 257, in airline service 22.			
Trans-Air 1 1	Dan-Air 4 Skyways 7 11	LIA 1 MEA 2 Trans-Med. 7 10	
BRISTOL			
BRISTOL 170: No built 214, in airline service 64.			
Wardair 1 1	Air Transport 1 Aviaco 3 Iberia 4 LTU 1 SCAL 2 BKS 3 Channel Air B. 9 Dan-Air 3 E. Anglian 2 North-South 1 Silver City 20 Trans European 1 50	Saudi Arab. 5 SNATA (Algeria) 2 7	Aigle Azur 1 Ansett-ANA 1 Straits AFE 4 6

N. and S. America	Europe	Mid-East and Africa	Asia and Australasia
BRITANNIA 100: No built 15, in airline service 15.			
BRITANNIA 300, 310, 320: No built 45 (exc. 23 milit. 252/253), in airline service 44.			
CPAL (310/320) 8 A'naves de Mexico (300) 2 Cubana (310) 3 Trans-continental (300) 2 15	BOAC (100) 15 BOAC (310) 16 British United (300/310) 4 Cunard Eagle 3 38	El Al (310) 4 Ghana (300/310) 2 6	

DE HAVILLAND

RAPIDE: No built 697, in airline service 108.			
SATGA 3 TAASA (Argentina) 6 TAM (Peru) 6 Taxader 4 19	Falcks 1 Iberia 1 Skycraft 1 Air Couriers 3 Air Navigation & Trading 4 British United 1 BEA 2 Jersey 1 MacSmith Air Charter 1 Skyways 1 Trans-European 2 18	Hürkus (Turkey) 3 Aero-Sahara 1 Africair 1 Air Brousse 4 Air Ivoire 3 Air Madagascar 5 Caspair 3 DETA 4 DTA 3 EAAC 4 Sierra Leone 3 SGAA (Algeria) 4 SNATA (Algeria) 1 STA (Angola) 3 TAGP 2 T.A. de Cabo Verde 1 TAG (Gabon) 2 Victoria Falls 3 Zambezi 3 53	Borneo 3 Madras Presidency 2 Alpine 1 Coastal 1 Connellan 1 NZNAC 2 Southern Scenic 2 Transpac 3 Trans-Island 1 West Coast 2 18
DOVE: No built about 520, in airline service 64+.			
Atlantic Seaboard ? Catalina Pacific 1 Desert 1 Golden Isles ? Gulf Coast 2 Sarnia ? TAG 2 Tampico 1 Timmins 1 Tropical 5 Taxis Aereos Nacionales 1 14+	Aero Transport 1 Balair 1 Dan-Air 2 Falcks 2 Itavia 1 Martins 1 SATA (Azores) 2 British United 6 Dan-Air 2 E. Anglian 3 Silver City 1 Trans European 2 24	Arkia 1 Gulf 3 Iraqi 1 DETA 4 Nigeria 1 Sudan 4 T.A. de Cabo Verde 2 16	All Nippon 3 Japan A.S. 2 T.A. de Timor 2 Air Charter 1 MMA 1 Robby's 1 10
HERON: No built 144, in airline service 69.			
TAG 1 Leeward Is. A.T. 2 3	Aviaco 5 Falcks 2 Itavia 1 UAT 6 BEA 2 British United 2 Cambrian 1 Cunard Eagle 2 Jersey 6 Metropolitan (Gatwick) 1 North-South 1 (L) Overseas Av. 1 30	Gulf 4 Turkish 7 (FS) Ghana 2 Nigeria 5 STA (Angola) 1 TAGP 1 20	All Nippon 3 (L) Indian A.C. 3 Japan A.S. 3 TAIP (Goa) 1 Toa Airways 2 Transpac 1 Associated 1 Fiji 2 16

N. and S. America	Europe	Mid-East and Africa	Asia and Australasia
COMET 4, 4B & 4C: No on order 53, in airline service 45.			
A. Argentinas* 4 Mexicana*** 3 7	BEA** 10 (4) BOAC* 19 Olympic** 3 (1) 32 (5)	MEA*** 1 (3) Misrair*** 3 EAAC* 2 6 (3)	

* Comet 4; ** Comet 4B; *** Comet 4C.

HANDLEY PAGE

HERMES: No built 25, in airline service 14.

Bahamas 2 2	Air Safaris 3 Silver City 4 Skyways 5 12		

SCOTTISH AVIATION

TWIN PIONEER: No built about 44 (exc. 36 milit.), in airline service 14.

	Scottish 2 2	BOAC1 Associates 2 Fison-Airwork 2 4	Borneo 2 de Kroonduif 2 PAL 4 8

SHORTS

SANDRINGHAM: No built 33, in airline service 12.

SOLENT: No built 23, in airline service 1.

A. Argentinas (Sand.) 6 CAUSA (Sand.) 3 9			Airlines of N.S.W. (Sand.) 1 Ansett-ANA (Sand.) 1 RAI (Sand.) 1 TEAL (Sol.) 1 4

VICKERS

VIKING: No built 166, in airline service 65.

LADE 2 T.A. Buenos Aires 2 4	Aero Transport 2 Air Nautic 4 Aviameer 1 Balair 2 D. Flugdienst 2 LTU 2 Mediteravia 1 Air Safaris 4 Cunard Eagle 8 Don Everall 1 E. Anglian 3 Maitland Drewery 2 Overseas 6 Pegasus 3 Tradair 8 49	Iraqi 3 Misrair 6 Protea 1 10	TAIP (Goa) 2 2

VISCOUNT 700 series: No built 285, in airline service 256.

Capital 55* Northeast 10 TCA 49 BWIA 5 Cubana 2 Cunard Eagle (Bermuda) 2 LANICA 1 LAV 3 PLUNA 3 TACA Internat. 1 131	Air France 8 (FS) Alitalia 9 Flugfelag 2 Olsen 2 BEA 25 British United 3 Cunard Eagle 3 Maitland Drewery 3 Starways 2 Tradair 2 59	Iraqi 4 Iranair 3 Kuwait 4 MEA 7 THY 4 CAAC 4 UAA 6 32	All Nippon 2 (L) IAC 10 Malayan 2 PAL 3 UBA 2 Ansett-ANA 2 TAA 13 34

* 15 with Vickers

VISCOUNT 800/810 series: No built 131, in airline service 120 (7).

Continental 13 Mar. Central 1 Cubana 3 VASP 5 22	Aer Lingus 7 Austrian 5 KLM 9 Lufthansa 9 BEA 38 British United 8 76	Ghana (3) Sudan 1 SAA 7 8 (3)	All Nippon (3) PIA 4 Ansett-ANA 5 TAA 2 NZNAC 3 (1) 14 (4)

FLIGHT Airliner Census . . .

COMMONWEALTH

North America	Latin America	Europe	Elsewhere
DE HAVILLAND (AUSTRALIA)			
DROVER: No built 20, in airline service 5.			
		Air Navigation & Trading 2 2	Fiji 3 3
DE HAVILLAND (CANADA)			
DHC-2 BEAVER: No built over 1,500, in airline service 153.			
Aircraft Holdings 2 Austin 5 B.C. Air Lines 8 B.C. Yukon 2 Canadian Aircraft Renters 2 Cascade 1 Eastern Provincial 8 Executive Air Service 1 Fecteau 6 Gagnon 2 Hudson Bay 1 Kenairways 1 Laurentian 7 Manitoba Govt. A.S. 5 Mar. Central 1 McMurray 1 Newfoundland Skyways 2 Nordair 2 Northern Wings 4 Pac. Western 17 Petersons 1 Sask. Govt. 5 Sherritt Gordon 1 Sioux Narrows Airways 2 Trans-Air 3 Trans-Gaspesian 1 Wardair 1 West Coast A.S. 1 Western Aero Renters 1 Wheeler 2 96	Aero Chaco 2 Aerotaxi 15 Bristow 1 CDA 1 Falkland Is. Govt. A.S. 4 RANSA 3 TAM (Peru) 4 Taxader 2 32		CAAC 5 Flights (1956) 1 World Wide Helicopters 4 Aigle Azur 1 Air Laos 1 Cie. Laotienne de Transports Aeriens 1 Cie. Laotienne de Commerce et de Transports 4 de Kroonduif 3 Malayan 3 Pioneer 1 Fiji 1 25

DHC-3 OTTER: No built about 350, in airline service 43.

Aircraft Holdings 1 Canadian Aircraft Renters 1 Fecteau 3 Hudson Bay 3 Manitoba Govt. A.S. 1 McMurray 1 Northern Wings 1 Pac. Western 4 Sask. Govt. 1 Superior 1 Wardair 4 Wheeler 2 23		Wideroes 4 4	Aigle Azur 4 Air Laos 2 Philippine 6 TAA 4 16

CANADAIR

DC-4M: No built 46 (exc. 25 milit.), in airline service 36.

TCA 21 (FS) 21 (FS)		Flying Enterprise 3 Overseas 6 9	Aden 3 EAAC 3 6

North America	Latin America	Europe	Elsewhere

NOORDUYN

NORSEMAN: No in airline service 100.

North America	Latin America	Europe	Elsewhere
Alaska 5	T.A. Orientales 1	Wideroe's 7	Cie. Laotienne de Commerce et de Transports 1
Interior* 3			New Bengal Airways 1
Wien Alaska 5			Gibbes Sepik 4
Austin 8			
Canadian Aircraft Renters 1			
Central 1			
Chukuni 1			
Gagnon 3			
Georgian Bay 3			
Gold Belt 4			
Halls Air Service 3			
Hudson Bay 1			
La Tuque A.S. 1			
McMurray 2			
Newfoundland Skyways 1			
Nordair 2			
Northern Wings 3			
Ontario Central 5			
Ontario Provincial 1			
Parsons 2			
Rainy Lake Airways 1			
Riverton Airways 1			
Rusty Myers F.S. 2			
Sask. Govt. 4			
Sault Airways 1			
Sioux Narrows Airways 1			
Superior 2			
Teal Air 2			
Thomas Lamb Airways 2			
Trans-Air 12			
Wheeler 3			
86	1	7	6

U.S.A.

BEECHCRAFT

MODEL 18: No in airline service 49+.

North America	Latin America	Europe	Elsewhere
Alaska 3	Cruzeiro 4	Escadrille Mercure	Arkia 2
Aspen Airways	LANICA 1		Syrian 1
Golden Gate	NAB 1		Aerotechnique 2
Northern Consol 1	S.A. Mediterraneos		Africair 1
Wien Alaska 1	T.A. Buenos Aires 2		DTA 4
B.C. Air Lines 1	VASP 1		UAA 1
Bradley 2			Foshing 2
Canadian Aircraft Renters 1			JAL 1
Canadian Nickel 2			Connellan 2
Chinook 1			Trans-Island 2
Halls Air Service 1			
Mar. Central 1			
Nordair 1			
Ontario Central 1			
Quebecair 1			
Sask. Govt. 1			
Timmins 1			
Trans-Gaspesian 1			
Wheeler 1			
World Wide 1			
22+	9		17

BOEING

B.307 STRATOLINER: No built 10, in airline service 9.

North America	Latin America	Europe	Elsewhere
	COHATA 1 (FS)	Air Nautic 2	Air Vietnam 1
			Aigle Azur 5
	1 (FS)	2	6

B.377 STRATOCRUISER: No built 56 (exc. 888 C-97/KC-97), in airline ownership 21.

North America	Latin America	Europe	Elsewhere
Northwest 6			
PanAm 15			
21			

707-120, 707-220: No built 64 (exc. about 400 KC-135 and 3 VC-137), in airline service 64 (5).

North America	Latin America	Europe	Elsewhere
American 25 (1)			Qantas 7 (3)
Braniff ('-220) 5			
Continental 5			
PanAm 6			
TWA 15			
Western 2 (L)			
58 (1)			7 (3)

North America	Latin America	Europe	Elsewhere

707-320, 707-420: No built 83, in airline service 83 (9).

North America	Latin America	Europe	Elsewhere
Northeast 1 (L)	Varig 2	Air France 16 (1)	El Al (2)
PanAm 22 (3)		BOAC 15	Persian A.S. 1 (L)
TWA 11		Lufthansa 4 (1)	SAA 3
		Sabena 4	Air-India 3 (2)
			PIA 1 (L)
34 (3)	2	39 (2)	8 (4)

720, 720B: No on order 87, deliveries in progress.

North America	Latin America	Europe	Elsewhere
American 8 (17)	Avianca (2)	Irish 2 (1)	Ethiopian (2)
Braniff (3)		Lufthansa (4)	
Eastern (15)			
United 11 (18)			
Western (4)			
19 (57)	(2)	2 (5)	(2)

CONVAIR

CV-240: No built 176 (exc. 395 milit.), in airline service 104.

North America	Latin America	Europe	Elsewhere
American 34	A. Argentinas 4	D. Flugdienst 4	Air Jordan 1
Mohawk 9	Cruzeiro 10	LOT 4	Ethiopian 3
Southeast 2	UMCA 2	Norronafly 1	Garuda 8
Western 5	Varig 12		
CPAL 5			
55	28	9	12

CV-340: No built 209 (exc. 108 milit.), in airline service 169.

North America	Latin America	Europe	Elsewhere
Allegheny 7	Avensa 5	Alitalia 4	Saudi Arab 10
Braniff 25	Cruzeiro 4	Finnair 3	Garuda 8
Delta 20	LACSA 2	JAT 1	
Frontier 5	Real 5	KLM 12	
Hawaiian 5		Linjeflyg 4	
North Central 5		Lufthansa 4	
United 40			
107	16	28	18

CV-440: No built 153 (exc. 26 milit.), in airline service 146.

North America	Latin America	Europe	Elsewhere
Braniff 5	Avensa 2	Alitalia 2	All Nippon 3
Delta 8	Cruzeiro 4	Aviaco 3	Garuda 3
Eastern 20	Real 14	Condor 2	Airlines of NSW 2
Fairways 1		Finnair 3	Airlines of S Australia 2
Hawaiian 2		Iberia 7	Ansett-ANA 2
Mohawk 5		JAT 2	
National 6		Kar-Air 2	
Transamerican 1		Lufthansa 5	
		Sabena 9	
		SAS 20	
		Swissair 11	
48	20	66	12

ALLISON-CONVAIR 340/440: No on order 5, conversions in progress.

North America	Latin America	Europe	Elsewhere
Lake Central (5)			
(5)			

CV-540: No in service 7, conversions in progress.

North America	Latin America	Europe	Elsewhere
Allegheny 5			
Quebecair 2			
7			

880, 990: No on order 88, deliveries in progress.

North America	Latin America	Europe	Elsewhere
American (990) (25)	Avensa (880) (1)	SAS (990) (2) (L)	CAT (880) (1)
Delta (880) 7 (6)	Real (990) (4)	Swissair (990) (7)	JAL (880) (3)
Northeast (880) 4 (2)	T'continental (990) (4)		
TWA (880) 2 (20)			
13 (53)	(9)	(9)	(4)

CATALINA/CANSO: No built 2,140, in airline service 48.

North America	Latin America	Europe	Elsewhere
Alaska Coastal 2	PAB 5	Flugfelag 2	Airways (India) 1
Pacific 1	Transa Chile 2		CAT 2
Austin 1	TAM (Peru) 4		Foshing 1
CPAL 1			Macao 1
Leaseair 1			RAI 1
Montreal A.S. 3			World Wide Helicopters 2
Northern Wings 2			
Nordair 3			
Quebecair 2			
Trans-Air 4			
Trans-Labrador 1			
Wheeler 3			
World Wide Airways 3			
27	11	2	8

FLIGHT Airliner Census . . .

CURTISS

C-46: No built 3,181, in airline service 378+.

North America		Latin America		Europe		Elsewhere	
Aaxico	33	Aerunion	2	Olsen	3	LIA	1 (FS)
Aero Enterprises	2	Aeronaves del Balsas	2	Transair Sweden	6	Air Cameroun	3
Air Cargo Exp.	2	Aerovias Je Condor	3			Aigle Azur	1
Alaska	3	Aerovias Q	4			CAT	18
All American	4	ANSA (Costa Rica)	1			Foshing	1
Argonaut	1	APA	2				
ASA	3	APSA (Peru)	1				
Associated	6	Austral	5				
Braniff	2	Avensa	3				
Cal. Air Freight	1	Aviateca	2				
Cal. Central	2	California	2				
Cal Hawaiian	2	CBF	3				
Capitol	17	CDA	4				
Connor	3	CEA	2				
Cont. Charters	3	COPA	2				
Cordova	1	Cuba Aeropostal	3				
Currey	2	Expreso Aereo	?				
Delta	5	Interamericano	3				
Federated	2	LAC	2				
Flying Tiger	2	LACSA	4				
Golden State	1	LANICA	1				
Imperial	2	LAUSA	2				
Interior	3	LAV	4				
L. & J. Trading Co	3	LEBCA	2				
Mercury	1	Lineas Interamericanas	? 3				
Miami	2	Loide	12				
Modern A.T.	3	NAB	1				
Pacific Internat.	1	Paraense	?				
Quaker City	?	R.A. de Colombia	?				
Regina	2	RANSA	13				
Resort	5	Real	11				
Riddle	29	Sadia	2				
Seaboard	1	SAHSA	2				
Skyways	2	TACA Internat.	1				
Southern A.T.	3	TAN	5				
Southern Cross	?	TAPSA (Peru)	?				
Trans-Carib.	1	T.A. Salvador	1				
Trans-Global	?	Tigres Voladores	1				
Universal	2	Transamerican Air Transport	?				
Westair	4	Transcontinental	7				
Whesport Air Cargo	2	Transa Chile	3				
Wien Alaska	4	Varig	14				
World Wide Airlines	5						
Zantop	12		135+		9		24
Aircraft Holdings	1						
CPAL	2						
Ghandonald	1						
Mar. Central	4						
Northern Wings	1						
Nordair	1						
Pac. Western	5						
Quebecair	1						
St Anne Airways	1						
Wheeler	4						
World Wide Airways	5						
	210+						

DOUGLAS

DC-3, C-47: No built 10,928, in airline service 1,574+.

North America		Latin America		Europe		Elsewhere	
Admiral	2	Actividades Aereas	1	Aer Lingus	5 (FS)	Aden	8
Aero Enterprises	1	ALA (Argentina)	4	Air France	32	Air Jordan	1
Allegheny	10	A. Argentinas	15	Alitalia	7	Air Liban	3
Aloha	7	Aeronaves de Mexico	26	Austria Flugdienst	1	Arkia	4
American Flyers	4	Aeronorte	4	Braathens	2	Gulf	2
Avalon	1	ANHSA (Honduras)	2	CSA	2	Iranair	13
Blatz	3	APSA (Peru)	2	Finnair	10	Kuwait	2
Bonanza	10	AREA	2	Flugfelag	3	MEA	4
Braniff	18	Avensa	14	Iberia	15	Saudi Arab.	10
Cal. Air Charter	1	Aviance	25	JAT	13	Syrian	4
Cal. Central	2	Aviateca	5	Kar-Air	3	THY	21
Cal. Hawaiian	2	Bahamas	4	KLM	10	Yemen	3
Capital	13	BWIA	4	Linjeflyg	10	Aerotechnique	3
Cal. Pacific	1	British Guiana	3	Lufthansa	3	Africair	12
Caribair	4	CDA	1	Martins	3	Air Algerie	3
Catalina Pacific	2	COHATA	3	Olsen	1	Air Madagascar	2
Central	15	COPA	2	Olympic	13	CAAC	5
Civil Air T'port	1	Cruzeiro	25	Sabena	29	DETA	3
Connor	1	Cubana	4	Swissair	8	DTA	7
		Faucett	7	TAI	2	EAAC	9
				Transair Sweden	2	Ethiopian	7
				Air Links	1	Ghana	4
						Liberian	2

(Continued at top of column 2)

(Continued from column 1)

North America		Latin America		Europe		Elsewhere	
Cont. Charters	1	LAB	7	BEA	22	UAA	4
Continental	10 (L)	LAC	1	BKS	4	Nigeria	8
Cordova	2	LACSA	3	British United	9	R. Air Maroc	3
Delta	12	LADE	2	Cambrian	2 (4L)	Rhodesian	1
East Coast	1	LADECO	2	Dan-Air	2	SAA	7
East-West Air	1	LAN (Chile)	17	Derby	7	Sudan	7
Executive Business Transport	2	LANICA	7	E. Anglian	4	Tunis Air	3
Fairways	1	LAUSA	3	Jersey	6	Air Ceylon	3
Farr Air, Inc.	1	LAV	28	Scottish	1	Air Laos	9
Fast-Way Air	1	LEBCA	1	Silver City	11	Air Outremer	1
Frontier	25	Mexicana	18	Skyways	5	Air Vietnam	7
General	2	NAB	12	Starways	3	Aigle Azur	5
Hawaiian	6	PLUNA	6			Airways (India)	3
Interior	2	R.A. de Colombia	3			All Nippon	8
Johnson	2	Rea	72			Ariana	4
Lake Central	12	Sadia	3			Cathay Pac.	1
Las Vegas Hacienda	2	SAHSA	5			CAT	5
Mackey	3	Santafesina	1			Combodge de Kroonduif	3 (L)
Mantz	1	SAVAG	6			Foshing	2
Mercer	1	T.A. Buenos Aires	2			Garuda	19
Miami	2	TAC (Brazil)	2			IAC	58
Mohawk	8	TACA de Hon.	10			Indamer	5
North Central	32	TAI (Mexico)	2			Kalinga	7
Northeast	10	TAM (Peru)	8			Korean Nat.	3
Northwest	4	TAMSA	2			Malayan	9
Ozark	24	Taxader	3			North Japan	1
Pacific	9	T.M. de Cortes	3			PAL	22
Pac. Northern	3	Tolima	5			PIA	10
Palm Springs	1	Varig	21			Royal Nepal	6
Panagra	1	VASP	11			T.A. de Timor	?
PanAm	2					Thai	7
Piedmont	20					UBA	8
Purdue	4					Adastra	1
Quaker City	?					Airlines of NSW	7
Reeve	3					Airlines of S Australia	5
Regina	1					Ansett-ANA	13
Samoan	?					East-West	4
Seaboard	1					MMA	6
Sourdough	2					Mandated	5
Southeast	4					NZNAC	26
Southern	18					Papuan	1
Standard	2					Qantas	2
Stewart	4					Queensland	3
Trans-Internat.	6					TAA	19
Trans-Texas	25						
Viking	2						
West Coast	14						
Western	2						
Wien Alaska	1						
Zantop	1						
Austin	2						
CPAL	4						
Canadian Aircraft Renters	1						
Eldorado	1						
Mar. Central	4						
Matane	1						
Montreal A.S.	2						
Northern Wings	2						
Nordair	3						
Pac. Western	5						
Quebecair	3						
Sask. Govt.	2						
Trans-Air	2						
TCA	9						
Trans-Labrador	3						
Wheeler	4						
World Wide Airways	3						
	443+		409		419		461+

DC-4, C-54: No built 1,163 ,in airline service 354.

North America		Latin America		Europe		Elsewhere	
Alaska	2	A. Argentinas	6	Air France	28	Air Jordan	2
ASA	2	A'naves de Mexico	3	Am. Internat.	5	Air Liban	1
Cal. Eastern	1	Aerovias	1	Balair	3	Iranair	2
Cal. Hawaiian	3	APA	1	BIAS	1	Jordan Internat.	1
Capital	12	ATSA	1 (L)	Braathens	2	LIA	2
Central A.T.	2	Avianca	10	CDL	3	Persian A.S.	2
Coastal	1	Aviateca	2	Flugfelag	1	Trans Arabia	1
Currey	1	CDA	2	Iberia	7	Trans-Med.	3
Eastern	1	Faucett	4	Interocean	1	Saudi Arab.	4
European Asiatic	1	Guest	1	Loftleidir	2	Syrian	3
Global	1	Ini	1	Olympic	2	Africair	2
Golden State	1	LAB	1	Sabena	5	Air Algerie	10
Great Lakes	2	LADE	2	TAI	2	SAA	5
Inter-continental	1	L.A. Nacion	1	TAP	3	Trek	1
Javelin	1	Loide	7	UAT	4	Tunis Air	3
Lancia	1	Mexicana	5	Brit. United	5	Air Vietnam	1
Las Vegas Hacienda	1	Paraguayan A.S.	1	Starways	3	Ariana	1
Mackey	3	RANSA	1			CAT	2
Miami	1	R.A. de Colombia	3			Cathay Pac.	1
Northwest	11	Real	2			IAC	5
Pac. Northern	1	TACA Internat.	1			JAL	10
Panagra	2					Korean Nat.	1
PanAm	18					TAIP (Goa)	2
PSA	4					Thai	2 (FS)
Reeve	1					Ansett-ANA	2
Resort	10					Qantas	3
Riddle	4					TAA	2
			56		77		74

(Continued in column 1 opposite)

North America	Latin America	Europe	Elsewhere

DC-4 and C-54 *(continued from column 2 opposite)*

North America		Latin America		Europe		Elsewhere	
Seaboard	3						
Seven Seas	4						
Slick	9 (L)						
Trans-Alaskan	3						
Trans-Carib.	2						
TWA	1						
20th Century	7						
U.S. Overseas	13						
Westair	1						
World Wide Airlines	1						
Zantop	2						
Eldorado	1						
Mar. Central	2						
Nordair	2						
Notre Dame A.T.	1						
Pac. Western	3						
Trans-Air	1						
Wheeler	2						
	147						

DC-6: No built 175, in airline service 161.

North America		Latin America		Europe		Elsewhere	
American	48	A. Argentinas	4	Alitalia	3	Air Jordan	1
Braniff	9	A'naves de Mexico	6	KLM	6	Air Liban	1
Continental	1 (L)	APA	1	Sabena	3	Cathay Pac.	1
Delta	11	APSA (Peru)	1	TAI	1	TEAL	3
Mackey	1	Guest	3	Transair Sweden	3		
National	4	Ini	1				
PanAm	4 (L)	Mexicana	7				
United	38						
	116		23		16		6

DC-6A & DC-6C: No built 75 (exc. 167 milit. DC-6A), in airline service 71 (1).

North America		Latin America		Europe		Elsewhere	
Alaska	2	Ini	(1)	KLM	1	Air Liban (C)	2
American	8	PAB (C)	4 (L)	Olympic	1	Persian A.S.	1
ASA	1			Swissair	1	Trans-Med.	1
Great Lakes	2			UAT	3	Ariana	2
Hawaiian	1			Brit. United	2	JAL	3
Northwest	7			Cunard Eagle	3		
Overseas Nat.	4						
PanAm	2						
Slick	2						
Trans-Carib.	2						
United	7						
U.S. Overseas	3						
CPAL	6						
	47		4 (1)		11		9

DC-6B: No built 287, in airline service 264.

North America		Latin America		Europe		Elsewhere	
American	21	Avensa	2	Alitalia	8	Air Liban	1
Braniff	1	LAN (Chile)	3	JAT	2	LIA	1
Capital	7 (L)	R.A. de Colombia	2	KLM	2	Trans Arabia	2
Continental	2	T.A. Costa Atlantica		Loftleidir	3	Ethiopian	3
Eastern	7			Olympic	3	Saudi Arab.	1
Los Angeles A.S.	2			Sabena	8	Cathay Pac.	1
National	7			SAS	9	CAT	1
Northeast	10			Swissair	7	JAL	2
Northwest	16			TAI	4	Thai Internat.	3
Overseas Nat.	1			UAT	7	Ansett-ANA	4
Panagra	4						
PanAm	32						
20th Century	2						
United	41						
Western	27						
CPAL	5						
	185		7		53		19

DC-7: No built 120, in airline service 98.

North America		Latin America	Europe	Elsewhere
American	24			
Delta	10			
National	4			
Overseas Nat.	12			
United	48			
	98			

DC-7B: No built 97, in airline service 94.

North America		Latin America	Europe	Elsewhere	
American	10			SAA	4
Continental	5				
Delta	10				
Eastern	48				
National	4				
Panagra	6				
PanAm	7				
	90				4

DC-7C: No built 121, in airline service 115.

North America		Latin America		Europe		Elsewhere	
Braniff	6	PAB	4	Alitalia	5	JAL	4
Northwest	16			KLM	15	Persian A.S.	2
PanAm	25			Sabena	7		
Riddle	7			SAS	7		
				Swissair	5		
				TAI	2		
				BOAC	10		
	54		4		51		6

North America	Latin America	Europe	Elsewhere

DC-8 (all versions): No on order 155, deliveries in progress.

North America		Latin America		Europe		Elsewhere	
Delta	6	A'naves de Mexico	1	Alitalia	3 (5)	JAL	3 (2)
Eastern	12 (4)	PAB	(4)	Iberia	(3)	PAL	(2)
National	3			KLM	6 (4)		
Northwest	5			Olympic	(2)		
Panagra	4			SAS	6 (1)		
PanAm	10 (7)			Swissair	3		
Trans-Carib.	(1)			TAI	1 (1)		
United	33 (7)			UAT	2		
CPAL	(4)						
TCA	4 (6)						
	77 (29)		1 (4)		21 (16)		3 (4)

FAIRCHILD

C-82A PACKET: No built 224, in airline service 19.

North America		Latin America		Europe		Elsewhere	
Trans-Internat.	1	Aviateca	1	TWA	1		
		Cruzeiro	7				
		Guest	2				
		LACE	2				
		Mexicana	3				
		TAMSA	2				
	1		17		1		

FRIENDSHIP—*See Fokker Fairchild Friendship, overleaf*

GRUMMAN

ALBATROSS: No in airline service 3.

GOOSE: No built 345.

MALLARD: No built 61, No in airline service 53.

WIDGEON: No built 286.

North America		Latin America		Elsewhere	
Alaska Coastal	8	Bahamas	3	Amphibian Airways	2
Avalon	7	British Guiana	3	PanAm (Trust Territory)	3
Catalina Channel	1			Tourist Air Travel	2
Cordova	2			T.A. de Cabo Verde	1
Ellis	9				
Mackey	2				
Reeve	1				
Western Alaska	?				
B.C. Air Lines	2				
BNP	3				
Canadian Aircraft Renters	1				
Hudson Bay	1				
Laurentian	1				
Ontario Central	2				
Teal Air	1				
Trans-Gaspesian	1				
	42+		6		8

LOCKHEED

L.10: No built 148, in airline service 17+.

North America		Latin America		Elsewhere	
Byerly	1	LAN (Chile)	2	Trans Island	1
Naples	?	Santafesina	3		
Prov.-Boston	2	Taxis Aereos Nacionales	1		
Matane	4				
Trans-Gaspesian	3				
	10+		6		1

L.12: No built 114, in airline service 6.

North America		Latin America		Europe		Elsewhere	
Western Alaska		Taxis Aereos Nacionales	1	Wideroe's	2	Associated	1
Trans-Air	1					Carsair	1
	1		1		2		2

L.14: No in airline service 5.

North America		Elsewhere	
Pacific Northern	1	Adastra	2
		East-West	2
	1		4

(Lockheed continued overleaf)

FLIGHT Airliner Census . . .

North America	Latin America	Europe	Elsewhere
LODESTAR: No built 625, in airline service 13.			
British American 1 Canadian Aircraft Renters 1 2	L.A. de Cuyo Norsur 3 3	Kar-Air 1 Linjeflyg 2 3	CAS (S. Africa) 2 DETA 3 5
L.049, L.149 CONSTELLATION: No built 88, in airline service 49.			
American Flyers 2 Capitol 10 Coastal Cargo 1 Las Vegas Hacienda 1 TWA 30 44		Trans European 1 1	El Al 4 4
L.649, L.749, L.749A: No built 133 (exc. 12 milit.), in airline service 119.			
Capitol 3 Eastern 17 Miami 1 Pac. Northern 5 TWA 38 64	A'naves de Mexico 2 Avianca 4 Guest 2 PAB 12 20	Air France 12 KLM 10 Skyways* 4 26	Air Algerie 2 R. Air Maroc 4 SAA 2 Korean Nat. 1 9
*Owned by BOAC			
L.1049A, 'C, 'D, 'E: No built 102 (exc. about 320 milit.), in airline service 86.			
Cal. Hawaiian 1 Eastern 28 Seaboard 3 South Pacific 1 TWA 7 20th Century 3 TCA 7 50	Avianca 2 LAV 1 3	Air France 9 Iberia 3 KLM 7 19	Air India 5 PIA 3 Qantas 6 14
L.1049G: No built 130, in airline service 98.			
Capitol 1 Eastern 9 Resort 1 TWA 28 TCA 4 43	Avianca 1 Cubana 3 Guest 3 LAV 5 Varig 5 17	Air France 12 Iberia 2 Lufthansa 7 KLM 9 TAP 3 33	Air Ceylon 1 (L) Air India 4 5
L.1049H: No built 54, in airline service 50.			
Capitol 1 Flying Tiger 14 National 4 Seaboard 3 Slick 5 South Pacific 1 TWA 8 TCA 2 38	Real 4 4	Aerlinte 3 (L) KLM 2 5	PIA 2 Qantas 1 3
L.1649A STARLINER: No built 43, in airline service 42.			
TWA 28 28		Air France 10 Lufthansa 4 14	

North America	Latin America	Europe	Elsewhere
L.188 ELECTRA: No on order 167, deliveries in progress.			
American 33 Braniff 8 Eastern 39 National 15 (8) Northwest 10 (8) PSA 3 (1) Western 9 (3) 117 (20)		KLM 12 12	Cathay Pac. 2 Garuda (3) Ansett-ANA 3 Qantas 4 TAA 3 TEAL 3 15 (3)

North America	Latin America	Europe	Elsewhere
MARTIN			
2-0-2, 2-0-2A: No built 43, in airline service 21.			
4-0-4: No built 101 (exc. 2 milit.), in airline service 90.			
Allegheny (202) 8 Eastern (404) 56 Lone Star (202) 3 Lone Star (404) 2 Pacific (202) 4 Pacific (404) 2 TWA (404) 30 105	LAN (202) 4 LAV (202) 2 6		
SOUTH AMERICA			
FAUCETT			
FAUCETT F.19: No built about 30, in airline service 4.			
	Faucett 4 4		
EUROPE (other than UK)			
N. and S. America	**Europe**	**Mid. East and Africa**	**Asia and Australasia**
BREGUET			
DEUX PONTS: No built 16, in airline service 12.			
	Air France 12 12		
NORD-AVIATION			
NORATLAS: No built and on order 353, in airline service 9.			
	UAT 6 6	Air Algerie 3 3	
SUD-AVIATION			
LANGUEDOC: No built 100, in airline service 5.			
	Aviaco 5 5		
CARAVELLE: No on order 103, deliveries in progress.			
United (20) Varig 2 2 (20)	Air France 24 (9) Alitalia 4 (4) Finnair 3 (1) Iberia (4) Sabena (6) SAS 11 (3) Swissair 4 (L) 46 (27)	Air Algerie 4 (2) R. Air Maroc 1 (1) 5 (3)	
JUNKERS			
JU 52/3m: No built 3,234, in airline service 8.			
T.A. Orientales 1 1	Iberia 2 2	DETA 2 2	Gibbes Sepik 3 3
FOKKER/FAIRCHILD FRIENDSHIP			
FOKKER F.27: No on order 86, deliveries in progress.			
FAIRCHILD F-27: No on order 83, deliveries completed.			
Aloha 6 Bonanza 8 (2) Northern Consol. 3 Ozark 3 Pacific 6 Piedmont 8 West Coast 6 Wien Alaska 2 Pac. Western (3) Quebecair 3 45 (5)	AREA 1 Avensa 5 T.M. de Cortes 1 7	Aer Lingus 7 Braathens 2 (1) Horten 1 KLM (2) LTU (1) THY (10) 10 (14)	Sudan (3) All Nippon (3) IAC (5) PAL 2 (1) PIA 1 (4) Airlines of NSW 3 Ansett-ANA 2 (3) Associated (1) East-West 1 MMA 1 NZNAC (8) Queensland 1 TAA 8 19 (28)
SAAB			
SCANDIA: No built 18, in airliner service 15.			
VASP 15 15			

"Flight" photograph

Buccaneering on the Moor

Developing Blackburn's Strike Aircraft

By HUMPHREY WYNN

IN the chief test pilot's office at Holme-on-Spalding Moor, the Blackburn Aircraft development airfield, a softly chiming clock melodiously tells the hours. Adjoining the office is a room armed with desks and telephones, its facilities shared by the pilots and flight test observers. Above these offices is the control tower, its flat roof decorated by UHF aerials (looking, said one visitor, "like upturned ashtrays"; or according to another, "like leftover Festival of Britain decorations"). From this roof the whole of the airfield is visible: three runways which came into use for Bomber Command operations in 1941 and from which (between then and 1945) Wellingtons, Lancasters and Halifaxes flew for attacks on enemy territory. Behind the control tower are two hangars, with the space between tower and hangars just wide enough to low-fly a Buccaneer with sensational aplomb, when the test pilots wish to display the aircraft's low-flying characteristics at really close quarters. Inside the hangars are Buccaneers in different states of readiness, variously equipped according to the type of development flying each has to undergo. Most of the technicians working on them are civilian employees of Blackburn Aircraft, but there is also a fair admixture of Naval personnel. Around the airfield stretch the long acres of flat East Riding countryside, sprinkled with names like Bunny Hill, Snake Hall, Ladies Parlour, Cleaving Grange, and the Land of Nod Inn.

Blackburn Aircraft moved their development flying activities out to Holme with the advent of the de Havilland Gyron Junior-powered NA.39 (Buccaneer-to-be) in 1958, for there was insufficient runway length on the factory airfield at Brough to handle the new type of aircraft. The Buccaneers are built at Brough, then taken out by road to Holme—a distance of 16 to 18 miles—on their own wheels with wings folded (an advantage accruing from the Naval design), and almost ready to fly.

Flying operations at Holme-on-Spalding Moor under its Blackburn ownership are controlled by the flight test manager, Mr J. T. Stamper, the programme being determined by two factors: results of tests at the airfield, involving manufacturers of ancillary equipment as well as Blackburn and de Havilland, and requirements emanating from the factory at Brough. To carry out the development work, there is a flying staff of five pilots and seven flight test observers. The former are headed by the chief test pilot, D. J. Whitehead, who took the NA.39 on its maiden flight in April 1958. He is assisted by G. R. I. ("Sailor") Parker, J. G. ("Bobby") Burns, Lt Cdr E. R. Anson (on loan from the Royal Navy, and shortly leaving to join the Buccaneer intensive flying trials unit at RNAS Lossiemouth) and R. J. Chandler. Chandler and D. Lockspeiser (the latter on loan from Hawker Aircraft) both converted to Buccaneers last year, at Boscombe Down. The flight test observers are E. J. Solman, M. R. Bailey, G. R. C. Copeman, T. D. Dunn, J. B. Pearson, T. Jackson, E. J. D. Nightingale and N. Graham.

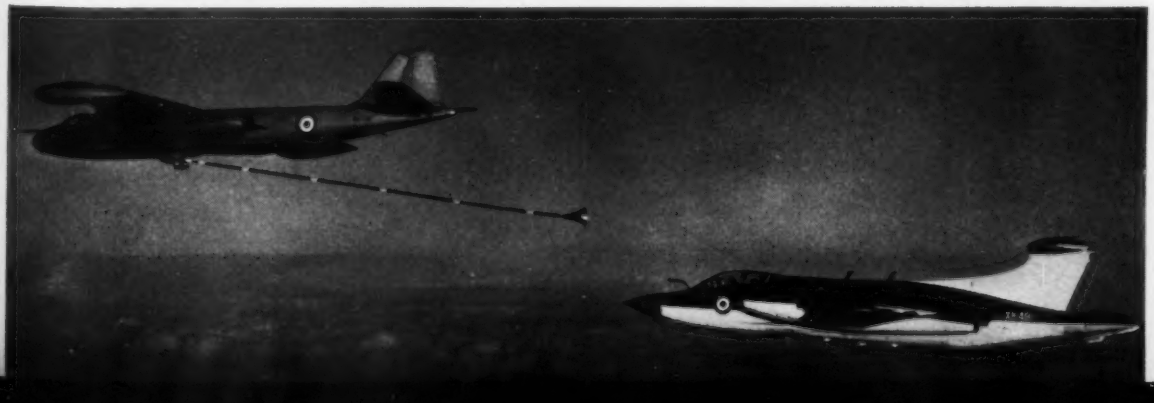
Although Holme-on-Spalding Moor, with its black hangars and three runways, presents superficially much the same sort of appearance it must have had as a wartime airfield, there are several differences in its present set-up. One is that the main 6,000ft runway (the only one used by the Buccaneers) has had two arrester gear installations, which can be used either on landing or to prevent overshooting. One of these worked on the "nylon pack" principle; once it had been used, and the nylon cable unwound, it took a considerable time to set up again for further employment. The latest gear, a product of John Curran Ltd of Cardiff (who aptly carry on their advertising brochure a Buccaneer silhouette), works on the "water squeeze" principle and is the first installation of its kind in this country. Retarding effect is produced by pulling two pistons through water-loaded arrester tubes on either side of the runway. This equipment, it is stated, can take aircraft "at engaging velocities up to 130kt." An arrester cable is stretched across the runway, 4½in above its surface, supported at intervals by rubber bobbins which allow the aircraft wheels to run over the cable but hold it high enough to engage the hook. The equipment allows a maximum run of 960ft in either direction.

Another feature which marks Holme-on-Spalding Moor out as an airfield where Naval aircraft are being tested is its mirror landing aid. This is not automatic, like those now used on carriers, but has to be set up manually; it is not aligned for landing into the arrester gear but is used to keep the pilots in practice only.

Like other aircraft manufacturers' test airfields, Holme has Cossor 21 surveillance radar with facilities for talk-down, giving the controller (Mr H. N. Smith) and his assistants the range and azimuth of a homing aircraft but not its elevation. In addition to this aid, and UHF, the Blackburn pilots have a useful topographical "homer." This is a canal which runs from the Humber almost up to the airfield, leaving the north bank of the river at a point almost opposite where the Trent enters it from the south.

Normally, test-flying of Buccaneers is done towards the north or north-east; but low-level tests are carried out southwards, in the designated low-flying areas of Lincolnshire, which are joined by link-routes specifically for the use of military aircraft. Higher flying imposes the greater problems, because of RAF and civil traffic in the vicinity of Holme. Some eight miles to the south is the northern edge of Green Two Airway, which extends eastwards and westwards from 3,000 up to 11,000ft. To the north-

Sinewy pirate: in the heading picture, J. G. ("Bobby") Burns inverts a Blackburn Buccaneer for the benefit of "Flight's" photographer. Below, a Buccaneer preparing to refuel from a Canberra during trials from the Tarrant Rushton, Dorset, airfield of Flight Refuelling Ltd



Above, a Buccaneer overshooting after a "touch-and-go." Below, J. G. Burns climbing aboard for a test flight. Note the Palouste ground-starter under the port wing

Buccaneering on the Moor . . .

At right, the Buccaneer's low-flying capability—and its unmistakable shape—being demonstrated at close quarters

east, 13½ miles away, is RAF Leconfield with its Hunter and Javelin squadrons; while RAF Finningley, near Doncaster, is 25 miles to the south-west—not far away as Vulcans fly on let-down patterns. The Blackburn pilots usually confine their flying to a 50-miles radius of Holme.

The majority of the 20 development Buccaneers have now been built, and work is in hand on the production contract. Two of these aircraft have been lost—one in October 1959 when it was being evaluated at Boscombe Down by a US pilot, both he and the Blackburn flight test observer losing their lives after ejecting at low altitude when the aircraft was inverted, and the other in October last year. In the latter case, both the pilot ("Sailor" Parker) and his observer (E. J. D. Nightingale) made successful ejections, and after convalescence are now completely recovered.

The completed Buccaneers are being used for a varied programme of development flying, including deck take-offs and landings (two of the aircraft were out in the Mediterranean for deck trials in November last year, getting their sea-legs aboard HMS *Ark Royal*). Each of the aircraft is used for different tests: for example, the fourth to be built was the first to have folding wings. One of the machines is being flown to assist Ferranti Ltd to determine the performance of their radar equipment.

Flying the Buccaneer, with its incorporated features like boundary layer control (which can increase the available lift by as much as 100 per cent under certain conditions and is used to decrease the approach speed), flap blowing, combined ailerons and flaps, rotating bomb-door and tail-mounted clamshell air brakes, involves new problems in handling. Initial stalling trials have been carried out and will shortly be completed, but all the indications are that the aircraft has very acceptable characteristics in this respect. Such trials are recorded on equipment in the control tower, though normally the documentation of flights is provided by the pilot's recorded commentary (as well as a knee-pad, if he has time and inclination to use it) and the observer's notes.

As in all test flying, writing reports takes longer than the actual flights, which on the average last an hour or an hour and a quarter. Pilot and observer listen to the recording and write their observations from it. During many of the Buccaneer test flights, a Hawker Hunter F.4 accompanies the Blackburn machine as "chase aircraft."

Standard Hussenot trace recorders are used to obtain normal flight records; but in addition a new technique of recording information on magnetic tape is being used with considerable success, particularly for investigating flutter. During the use of the equipment for this purpose, artificial transmissions of oscillation to the flying surfaces are made by firing specially positioned cartridges known as "bonkers." This is the first time in this country that a development team have been given such a complete picture. In this context, it is worth quoting from a *Flight* article of May 9, 1958, on the NA.39. This stated that "in either the subsonic or the supersonic regimes it is possible to know the position of the centre of pressure and to obtain a clear idea of the airflow around the whole aircraft, but in-between conditions change drastically

and rapidly. Divergent flutter must be avoided at all costs. . . ."

Features like the use of ailerons as blown flaps, enabling the aircraft to be brought in at high thrust and facilitating power of manœuvre at speeds close to the stall, and the installation of clamshell air-brakes at the tail-end of the fuselage, emphasize the severely pragmatic quality of Buccaneer design. During development flying, the tail of some of the aircraft has been modified by the addition of a bullet-shaped projection sprouting from the fin at the point where the tailplane is mounted. Such a change cannot be said to spoil the lines of the Buccaneer, whose beauty is a matter of opinion. As *Flight* wrote in 1958, "the area ruling is so pronounced as to be almost grotesque." But clearly, if an aircraft is built for a specific military purpose which involves high speed at levels below radar coverage, aerobatic capability in a LABS manœuvre, and ability to take-off from and land on carriers, beauty of line must needs be subservient to aerodynamic efficiency and constructional toughness. Changes in the Buccaneer's appearance during its development have resulted from liaison and exchange of ideas between the Blackburn design staff at Brough and the flying personnel at Holme.

On the desk occupied by J. G. Burns in the Blackburn test pilots' office is a model he has made of the Buccaneer, depicted carrying an air-to-surface missile. This equipment may or may not be significant, but it typifies the kind of operational thinking inevitably done by those engaged in developing a new military aircraft. In the model cockpits are a pilot and observer, the two-man team which forms the operational element in Naval aircraft like the Sea Vixen and Buccaneer.

Buccaneers are due to enter Naval service early this year with the formation of 700Z Flight, the Royal Navy's Intensive Flying Trials Unit, at RNAS Lossiemouth. Incorporating as it does so many new ideas, the Buccaneer has had a comparatively short development period, as military aircraft go these days; for it is less than three years since the NA.39 made its first flight at Bedford (April 30, 1958). When recently there were reports of larger engines being installed in the machine, the Civil Lord of the Admiralty, Mr C. I. Orr-Ewing, referred to its D.H. Gyron Juniors in a statement at Brough during last November in these terms:

Three Blackburn flight test observers: from left to right, Mike Bailey, Neville Graham and Gordon Copeman

"The present engines bring the aircraft fully up to specification." He added that the aircraft had "quite a lot of development stretch" within its design—presumably a reference to more powerful engines.

Mr Orr-Ewing went on to say that it was believed that the causes of the two Buccaneer accidents had been correctly analysed, and they did not affect the Admiralty's confidence in the machine. He added: "We believe this is a first-class aircraft. Flying and deck-landing trials have been highly satisfactory and the sooner the Navy get it, the better."

"Flight" photographs, with the exception of the picture above

Visual Flight Simulator

AFTER several years of concentrated development, General Precision Systems Ltd, of Aylesbury, Bucks, have completed the first model of an effective visual simulator system which can be added to almost any existing aircraft simulator or group of simulators. A similar objective has been achieved before, but only with rigid models of very considerable size scanned by closed-circuit television cameras mounted on moving gantries; one such model is no less than 95ft long. GPS have succeeded in mounting a realistic, three-dimensional model at 1 : 2,000 scale, covering a ground area equivalent to 12 n.m. by 3.3 n.m., on a continuous moving belt. The scene is scanned by closed-circuit television slaved to aircraft movement and either projected ahead of the simulator or displayed close to the windscreen on a television tube.

The cost of the Visual Flight Attachment, as it is called, is a little under £40,000 and deliveries could be made in nine months. The device meets both civil and military specifications in Britain and America and considerable interest has already been shown. A *Flight* representative handled a simplified, typical turboprop airliner and proceeded to demonstrate the simulator, making a number of take-offs and ILS approaches in a variety of ceiling and visibility conditions and in lighting from broad daylight to full night.

The realism of both scenery and motion, with accompanying engine noise and wheel rumble, was most impressive. Nosewheel steering and brakes could be used on the ground and the "aircraft" bounced most realistically if roughly landed. In training, the psychological effect of having to carry an instrument approach right through to a full stop on the runway must be very considerable, quite apart from the ability to practice actual minimum-visibility landings. In addition, the visual attachment makes it possible to gain some familiarity with the handling characteristics of a new type of aircraft before first flying it; and co-pilots can practise the technique of telling the captain when to go visual.

In developing this system GPS have solved numerous problems. The model is based on a continuous belt of fabric on which the ground features are plotted either from an aerial photograph or from a large-scale outline map. In the case of the London Airport model, some 75,000 miniature houses and 250,000 trees were mounted on the belt, ground texture being carefully reproduced by rough and very smooth finishes and colouring in various shades of grey and dark blue (models of representative airfields can also be used). Forward movement is accurately reproduced by driving the belt over two rollers of 2ft 6in diameter.

The scene is viewed by a Marconi image orthicon, closed-circuit television camera mounted normal to the belt, its line of sight being turned through 90° by a mirror. The aperture is stopped right down and the field of view set at 60° to provide the best definition. Lateral displacement of the aircraft is reproduced by movement of the whole camera mounting across the face of the model; and height by camera movement normal to the model. Roll, yaw and pitch movement of the aircraft are fed in by appropriate movement of the camera lens-system. Aircraft movement is derived from the computer of the aircraft simulator.

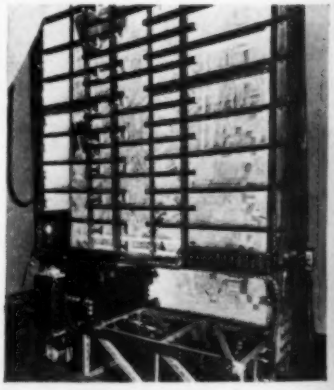
Cloud-base is regulated by the insertion of a card in the lens assembly; and a second card is introduced to restrict visual range and introduce mist or fog effects. The cards are electrically positioned according to values preselected at the controller's monitor position, where the picture can also be adjusted. Cloud-base from 1,000ft to zero and visibilities from 4.5 n.m. to 300ft can be selected. If the aircraft turns more than 30° from the model axis it automatically becomes IFR. If the viewing mirror descends to less than the equivalent of 60ft from the model outside the airfield area it is automatically retracted to 100ft; and if this proves ineffective, the mirror is displaced by striking the model, when microswitches and a precompressed spring automatically cause the camera to move sharply back.

The face of the model is illuminated by fluorescent strip lighting and inclined flood-lamps to give both daylight and shadow effect. The light can be dimmed to produce the effect of dusk or complete darkness. Runway and approach lighting of appropriate brightness is produced by strip lights behind the model, reflected by the bevelled edges of plastic inserts in the canvas. Street lighting near the airport is simulated by highly reflective points which pick up even the dim overall surface lighting applied for full night.

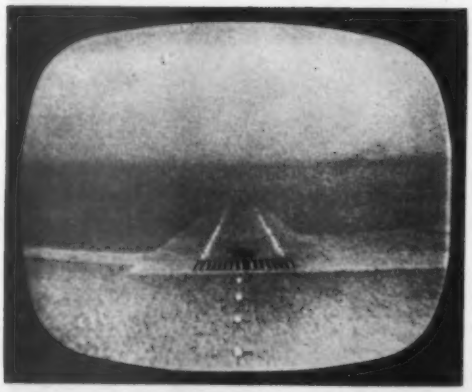
The whole model and camera assembly is 20ft high; but if, as seems likely, some operators require a maximum cloud-base of only 500ft, the height of the model assembly could be halved. Alternatively, the scale of the model could be increased to 1 : 1,000 with better definition. Camera focus is automatically adjusted.

To create the scene ahead of each pilot, either a projector or monitor screen may be used, two of one kind or one of each, according to requirements. Each pilot must have a presentation correct for his viewpoint, but the projector can be freely located and adjusted to avoid distortion. With a moving-base simulator, projector and screen are mounted on the cockpit assembly. To keep their edges out of sight, the displays are viewed through clear windscreen-wiper segments in the frosted windscreen panels; and this has proved comfortable and effective in the demonstration installation. The projector screen measures 6ft × 8ft and is positioned 10½ft ahead of the pilot's eyes. It is intended that 625-line television with 27in tubes should be employed. Further refinements, such as colour television, may be accommodated when they become available.

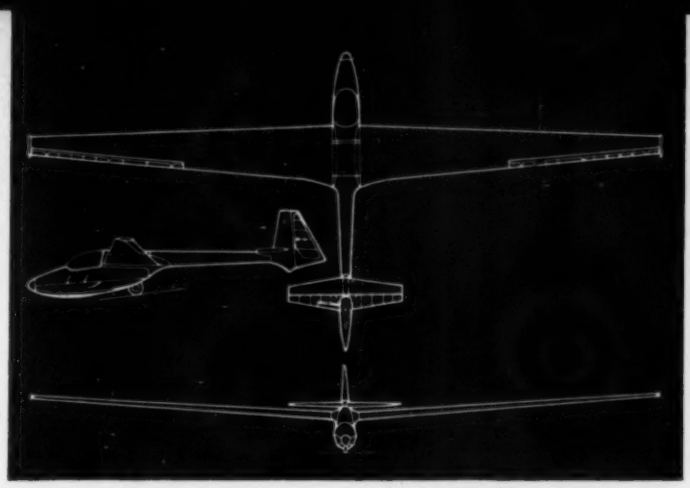
Left, reading anti-clockwise: London's 28L runway seen on the monitor screen at 400ft in 4½ n.m. visibility; at 150ft in 700yd visibility; and over the threshold at 100ft in 4½ n.m. visibility at dusk



Right, the 1 : 2,000-scale model on its endless belt aligned vertically in its 20ft-high frame with strip- and flood-lighting in front of it. The camera, which moves vertically and sideways, is at the foot of the frame



Sport and Business



Pod-and-boom construction is featured in the SZD-25 Lis (Fox), a new fifteen-metre-span Polish glider

NOMINATIONS for the Jean Lennox Bird Trophy and the Brabazon Cup for 1960 are invited by the British Women Pilots' Association. Candidates for the awards must be British women pilots with at least a student pilot's licence or a gliding B certificate. The Bird Trophy will be awarded for work over a period or a series of achievements, and the Brabazon Cup for a single outstanding achievement, during 1960. "Anyone with an interest in aviation" may nominate candidates (details to Miss M. Woodall, 3 St James's Gardens, London W11); all nominations will be in confidence; and the awards are to be made at the end of April.

DURING THE 1960 FISCAL YEAR ending on September 30, Cessna Aircraft Co again sold more light aircraft than any other United States company. The Cessna share amounted to 47 per cent of the numbers of aircraft, and 36 per cent of the total value. Although total sales decreased slightly, compared with the previous year, from $105,786,000 to $103,278,000, the company's export sales increased from $6,959,000 to $10,497,000. The number of aircraft exported increased from 494 to 709. In the annual report to stockholders, company president Dwane L. Wallace mentioned the expansion of Cessna operations during the year with the acquisition of a minority interest in Avions Max Holste of Reims; and the acquisition as a wholly owned subsidiary of McCauley Industrial Corp, the propeller manufacturers of Dayton, Ohio.

AT SEABROOK (KENT) MAGISTRATES' COURT on December 29, Alan James Bennett was fined £40 for being the commander of an aircraft and failing to satisfy himself that a flight could be made safely; £10 for acting as the radio operator of an aircraft without a licence; £10 for operating the radio station of an aircraft without a licence, and £40 for operating the radio so as to cause interference, impairing the efficiency of telecommunications. He pleaded guilty to the first three charges but not guilty to the fourth.

It was stated that Bennett took off from Southend in a Prentice on August 25 with four passengers. It was his intention to fly to Le Touquet but, before he reached the Channel, he realized that it would be too dark to go on. He turned back and landed at Lympne which was, at that time, closed to aircraft. The following day, after conversation with an air traffic controller at Lympne, it was agreed to maintain radio contact while Bennett continued his flight to Le Touquet. The procedure he used on the flight was of a type no qualified operator would have used. "Either he was totally inexperienced," said Mr D. G. Williams, prosecuting, "or he deliberately flouted the rules of radio procedure." Other aircraft had their messages blocked by his transmitting when he should not have been on the air at all, and very dangerous circumstances could have arisen. A Gemini on its way to Lympne was not able to acknowledge clearance for landing because of this interference. Two other aircraft were being dealt with. One had to change to another frequency and it was some time before the other could be helped.

Bennett said that he was under a misapprehension as to the need for a licence, and that he was not as inexperienced as the prosecution made out. He had no reason to think he was interfering with anyone else, and he heard absolutely nothing on the frequency used. He had been flying for more than five years. The chairman of the magistrates told Bennett that the charges could have resulted in fines amounting to £600 and the possibility of imprisonment.

RETROSPECT

From "Flight" of January 21, 1911

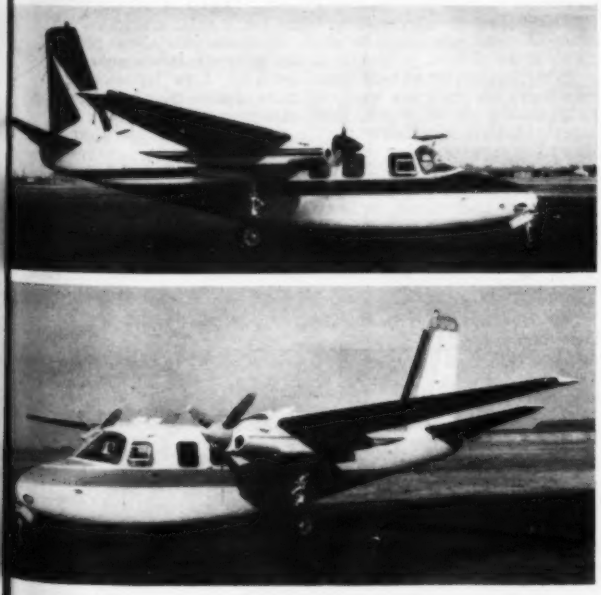
Aero Clubs in Canada: We are daily being reminded by the way subscriptions for *FLIGHT* come from remote corners of the earth that interest in aviation is world-wide. It may be interesting to many of our readers to learn from one of our correspondents that even in the town of Oshawa, Ontario, for instance, there is a small club which meets once a week for the purpose of discussing flying matters, each member taking a turn at reading a paper.

AUSTRALIAN LIGHT AIRCRAFT dealers sold 150 light aircraft during 1960 valued at £A1,500,000. The biggest buyers were graziers who used aircraft in their daily work and for journeys to towns. Light aircraft are reported to have grown into a business worth more than £A1,000,000 p.a. Main factor on the growth of sales has been the lifting of import restrictions, and at least ten types of light aircraft from North America are available.

On the other hand the Australian AOPA has asked members to try to improve the accident record—described as "appalling"—during 1961. During the last two years there have been serious accidents to light aircraft at the rate of one every three-and-a-half days, not including minor accidents which did not cause injury. The main type of accident was striking high-tension cables.

ORDERS FOR MORANE RALLYES totalled 150 by last Christmas Day, 76 of them from customers in 16 foreign countries. The 90 h.p. and 100 h.p. versions are now called MS.880 Rallye Club, and the 145 h.p. version MS.885 Super Rallye. The present schedule calls for the completion of the true production prototype 90/100 h.p. version this month, completion of the 145 h.p. prototype and the fourth airframe (for structural tests) in February and the four first production aircraft during April. Thereafter, 16 will be made in May, 20 in June and 30 in July. Production will then remain at 30 per month for the whole initial batch of 250. Morane have ordered from Continental a batch of 150 engines of 145 h.p., 125 of 100 h.p. and 25 of 90 h.p., deliveries to begin in March.

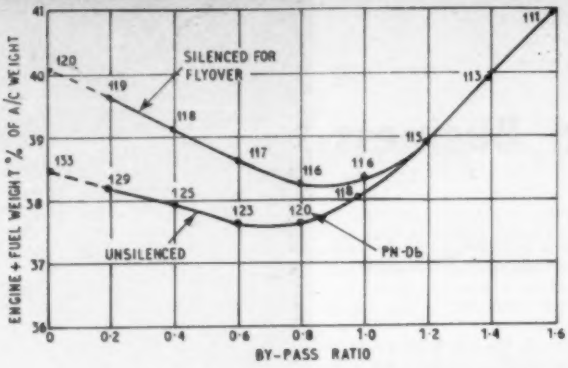
DERIVED FROM the single-seat Breguet 905 Fauvette, the Breguet 906 Choucas has been selected by the French Government to equip national gliding centres and private gliding clubs. Its role will include both basic and advanced training. The Choucas was chosen in preference to the Wassmer Bijave.



A brace of newsworthy Aero Commanders: (upper photograph) the 1,001st production machine, a Model 680F purchased by Asahi Press of Tokyo—who still operate also the first production Commander, a Model 520 purchased eight years ago; and the Commander 500B, first on the British register, recently acquired by Mr Geoffrey Woods, president of Woods of Colchester Ltd

Trends in Propulsion

AN RAeS LECTURE ON ROLLS-ROYCE RESEARCH



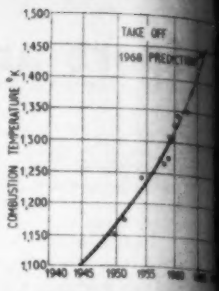


Fig 1 (left). By-pass optimization study; engine plus fuel weight for 1,500 n.m.
Fig 2 (right). Increase in combustion temperatures of turbojet engines

IN the introduction to the main lecture which was to be read before the Southampton branch of the Royal Aeronautical Society yesterday, January 19, Mr Harry Pearson, chief engineer (performance and research) of Rolls-Royce, said that it was trends within the next five to seven years and not the future of aircraft propulsion which he intended to discuss.

It had been found in America, said Mr Pearson, that conversion of existing engines to fan engines was a fairly economical method of increasing thrust, particularly for take-off. Also, take-off noise annoyance acted as a catalyst in favour of the by-pass type. Almost overnight the Rolls-Royce by-pass engine was faced with competition from fan engines with by-pass ratios of something like 1.5. Rolls-Royce took leave to doubt the correctness of these conversions; they had always been of the opinion that at current operating temperature the optimum ratio was between 0.6 and unity, take-off noise being improved at higher ratios.

Specific fuel consumption diminishes as by-pass ratio increases but above unity the improvement is small and a higher ratio means a larger engine diameter. On installed s.f.c. alone 1.2 is the maximum useful by-pass ratio, while above 0.6 powerplant weight increases rather rapidly, and for ranges between 1,500 n.m. and 4,650 n.m. (London - San Francisco) 0.8 is near the optimum.

Comparing engines on a basis of noise levels, where a given cruise requirement has to be met and a given take-off is required, with a low by-pass engine take-off is achieved as a design requirement and the cruise conditions will be somewhat throttled back. For high by-pass engines the cruise becomes the design requirement, take-off being a relatively easier condition. The results of one study are shown in Fig. 1.

Reduction of take-off noise by increasing by-pass ratio is largely fruitless because compressor and other noise will become a dominating source. At present operating temperatures and speeds by-pass ratios above unity are not desirable.

But as combustion temperatures are increased somewhat higher by-pass ratios tend to rectify the situation where jet velocities increase with detriment to both propulsive efficiency and noise.

Other parameters besides by-pass ratio are changing with research and development. As compressor temperature rises or pressure ratio increases specific fuel consumption diminishes, but engine weight increases with additional compressor and turbine stages. If combustion temperature continues to rise at the present rate higher pressure ratios are worth exploiting. Within seven years a ratio of 20 could be achieved in two-shaft engines.

Supersonic aircraft act as a spur to an increase in combustion temperatures and at higher by-pass ratios a worthwhile improvement in economy occurs; in seven years a cruising temperature of about 1,350°K could be achieved and take-off combustion temperature equivalent would be about 1,450°K.

By 1967 or so engines in the 10,000-20,000lb thrust class could have 18 per cent more take-off thrust than a current engine for the same airflow and 23 per cent more cruising thrust. Specific fuel consumption would be 3½ per cent higher. The engine would be about five decibels noisier so it seems desirable to operate at constant specific thrust and a by-pass ratio of about 1.5 to 1.6; noise and pod drag would then be unaltered, specific fuel consumption four per cent greater, and specific weight ten per cent lighter. Development of noise reduction techniques—such as variable area devices within the engine—should make the next generation of jets some 12 PNdb better than at present.

For short-range jet aircraft simpler engines of higher fuel consumption but of reduced weight and cost are required.

The future of turboprops remains in doubt; they are complex and military demand has not been great. Improvements in performance should come about by raising combustion temperature and pressure ratio and from improvement in design and weight. Provided designers are not faced with designing smaller and smaller engines combustion temperatures could reach cruising values of 1,350°K towards the end of the next decade giving a seven per cent improvement in range. These improvements applied to an engine of Tyne dimensions could give an increased power of 16 per cent coupled with a reduction in s.f.c. of eight per cent. Airflow could be increased by about 20 per cent giving a power increase of 39 per cent and a net gain in specific weight of 20 per cent, although the overall specific weight of engine plus propeller would remain about the same.

Supersonic flight presents the turbo-jet in its most favourable light, overall efficiency at Mach 2 comparing with best power station practice.

But if engine size is not to become prohibitive supersonic transport success turns on the ability to run engines at high combustion temperatures. Apart from this and a bulky intake-control system the engine becomes simpler than current types. Reheat may be called for if the transition height to supersonic flight is very great.

Combustion temperatures 100-200°C higher than those current (cruising temperatures of about 1,350°K) will be necessary and blade material suitable for another 100°C must be forthcoming. This appears possible. The design of propulsion nozzles is not yet well understood; a variable nozzle of some type must be used and an ejector nozzle has possibilities, but no satisfactory solution seems yet available. Airfield noise levels will depend on climb technique but although installed thrust is high, lift/drag ratio is low, and the height of a supersonic aircraft over residential communities will not be so high as a subsonic aircraft of similar power. Landing noise will also present problems but the variable air intakes that are needed (Fig 4) should help to solve this.

No completely acceptable solution for VTOL transports has emerged from propulsion studies. Separate jets allow powerplants to be chosen to operate in the most efficient manner but a lifting engine is an additional penalty. Low jet-velocity is mandatory for low noise level and more success may be achieved by designing round a propulsion-and-lifting duct system. For supersonic interceptor aircraft propulsion powerplants will probably be capable of lifting the aircraft off vertically by powerplant rotation or jet deflection. With strike aircraft there is an advantage in the use of only one powerplant but consumption is impaired because the engine must be heavily throttled for cruise. The use of several special lift engines and a separate propulsion engine, on the other hand, has the disadvantage that a number of lift engines have to be provided. The next four years should see important developments in this field.

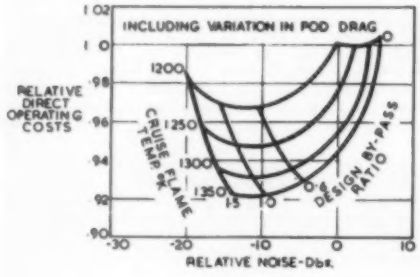


Fig 3 (left). Variation of direct operating cost and take-off noise with combustion flame temperature and design by-pass ratio

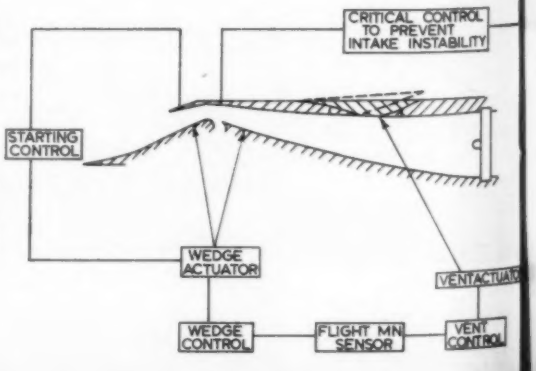


Fig 4 (right). Variable wedge-intake control arrangement for a supersonic aircraft

BRITISH AIRCRAFT CORPORATION

The new force in world aviation

The four member companies of British Aircraft Corporation have, since the war, constructed over 5,000 aircraft of all types. This number includes:
500 Four-Engined Turbine Airliners 900 Twin and Four Jet Bombers 1,700 Jet Fighters 1,100 Trainers
The aircraft now being built or developed within British Aircraft Corporation include VC10, Super VC10 and BAC-107 rear-engined jetliners, Vanguard and Viscount turbo-prop airliners, Canberra jet bombers, Lightning and TSR-2 supersonic military aircraft, the Jet Provost trainer, the T-188 all-steel supersonic research aircraft and a project study for a supersonic airliner * Guided weapons produced by British Aircraft Corporation include Bloodhound, Thunderbird, Blue Water and Vigilant * British Aircraft Corporation combines the aircraft and guided weapons interests of:

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Together these famous companies have fashioned a powerful new force in world aviation. It is backed by great resources and by a confidence, an experience, and a knowledge unique to an organisation whose aircraft are today in service with 50 airlines and with the armed services of 28 nations.

TGA 6AC2/1

TCA and BEA

AND THE VANGUARDS

BEA British European Airways who pioneered Vickers' Viscount travel and is now introducing the magnificent new Vanguard, has been able to lead the world in fare reductions. Cuts of up to 40% with an average reduction of 25% have been made possible by turbo-prop economy.

Mr Gordon McGregor, President of TCA, has this to say:

'The revision of TCA's fares is directly associated with the Company's plans for an all-turbine fleet in 1961. The lower unit operating costs anticipated from the Vanguard were a basic factor in the calculation of the new fare structure. TCA's highly satisfactory experience with the Viscount gives promise that its larger turbo-prop stable-mate, the Vanguard, will have an equally favourable impact upon air transport economies.'

CUT TRAVEL COSTS

Leaders of Viscount turbo-prop travel in North America, Trans-Canada Air Lines announces its lowest-ever fare structure. TCA's new Economy fares between Canada and the USA and its Excursion fares within Canada, are the lowest in the Airline's history. TCA Vanguards enter service on 1st February.

S A BASIC FACTOR

TCA BVA12

VICKERS **VANGUARD**

FOUR ROLLS-ROYCE TYNE TURBO-PROP ENGINES

VICKERS-ARMSTRONGS (AIRCRAFT) LIMITED WEYBRIDGE SURREY A Company of

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ONE HUNDRED PALL MALL LONDON SW1

THE ROYAL AIR FORCE FLIES INTO A MACH 2 WORLD

The English Electric Lightning has started its Royal Air Force career. The first squadron has been formed; others are following close behind. And so a new and most formidable defensive weapon comes into operational being—an all-weather, day and night interceptor that has twin-engine safety built into it. The Lightning is stable and docile at all speeds without the assistance of electronic devices. As a weapon system and as an achievement in applied aerodynamics, **nothing more advanced than the Lightning is in service anywhere.**

THE INCOMPARABLE *LIGHTNING*

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Straight and Level

IN a week or two's time Britain's new Air Transport Licensing Board is to open shop. This Board will, says Mr Peter Thorneycroft, Minister of Aviation, be an *independent* body. By this he means that it will be independent of his Ministry.

Good. But what would you say were the most important fundamentals of the air transport business which the new Board is to license? Traffic rights? Fares?

Alas, the new Board will have no powers whatsoever concerning traffic rights, and no powers regarding international fares. All such powers will remain vested in the Minister.

Anyway, he says the new Board (five of whose six members have no aviation background) will be independent. I don't know about you, but I think the Minister is talking—well, with his tongue in his cheek.

AIR SERVICES LICENSING COUNCIL

Notice of Application received (together with postal order for £3,246,002 in respect of application fees):—

Ref. 29002/AL/92004/2(ii):

FROM Plummet Air Lines Ltd, Boost Buildings, London, W1, for a series of scheduled services between every point in the world listed in the January 1960 edition of *ABC World Airways Guide* and every point listed in current BOAC and BEA timetables.

AT a frequency of 60 flights per day in each direction initially, rising to 60 flights per hour according to demand.

THESE services to be operated with any or all of the following types of aircraft: D.H. Tiger Moth, Vickers Super VC10, Avro Anson, D.H. Trident, Douglas DC-3, Douglas DC-8, Farman Goliath, Convair 990, Ford Trimotor, Vickers Vanguard, Handley Page BLC-0/400 and Boeing D.H.121.

TARIFFS on all routes to be half the applicable IATA fare.

* * *

Note: In anticipation of the possibility that licences for a few of the routes included in these applications may be refused by the Council, and to save the Council's time, a simultaneous appeal in respect of all these applications is being lodged with the Minister.

● Mr Harry Pearson, chief engineer (performance and research) of Rolls-Royce, said at a recent lecture:—

"If this lecture were being given three years earlier, I should have had to go through the arguments of explaining the by-pass principle in some detail and just why my company considered it superior to the straight jet engine for subsonic jet aircraft.

"Now, however, the picture is so different that I am rather put in the position of explaining why we think that very high by-pass ratios are not the best solution. I wish I could say that this reversal has been brought about by the superior sales record of the Conway over its main competitor; in default of this we have to be content with receiving the medal, and reflect that it might have been of nobler metal if we had decided to call it a fan engine instead of a by-pass engine."

● Here is a news item which, I imagine, our Minister of Aviation must hope has not been read by noise-sensitive London Airport residents:—

The Danish Government is buying up and demolishing 78 houses near Copenhagen-Kastrup airport at a reported cost of £350,000, and will provide the 400 residents with alternative accommodation elsewhere . . ."

● Surely one of the great anomalies in communications radio is the use of 117.9Mc/s as the common VHF channel for the RAF, NATO and part of the USAF. The other military VHF frequencies are all well above 130, and 117.9 is in any case not a communications frequency at all, being in the VHF navigation band for VOR.

In Britain we have got along well enough with 117.9, but the small American radios now being imported have to be specially fitted with 117.9 if the owner wants to have the military frequency available. Some American sets can hardly be modified at all. This is a shame, because 117.9 is very useful even if one does not regularly visit RAF stations, a good number of which are now available to private aircraft. To listen out on 117.9 can provide a good deal of useful information about military traffic in the vicinity and is invaluable if for some reason you have to fly close to a military airfield. In "V-bomber alley," broadly between Lincoln and Cambridge, there is also plenty of useful military radar surveillance available.

I suppose that if the RAF gave up 117.9 they would move to some even more unattainable frequency. Luckily there seems to be no prospect that they will move out of the VHF band altogether and concentrate on UHF.

Incidentally, it might be useful *in extremis* to remember that the UHF distress channel of 243Mc/s is double the VHF distress frequency of 121.5Mc/s and that it is sometimes possible to break through from one to the other.

Rain, rain, rain . . . looking back over the past year it seems to have done nothing but. Poor old pilots. Anyway, they've got automatic landing to look forward to. "What's this place—Renfrew? But weren't we heading for Prestwick? Never mind, Renfrew will do. Just so long as it isn't Abbotsinch . . ."

● "People think we are a lot of mugs."—Mr Bill Benson, chairman of the BOAC shop stewards committee.

Mars Bars?

● Soviet Academician Mr L. A. Artsimovich, denouncing rumours about flying saucers landing in Russia, says it is claimed that tiny men from Venus landed in Uzbekistan and Tadzhikistan and "jumped out of a flying saucer and began searching for a place to buy sweets . . ."

ROGER BACON

With twelfth night came the sad task of removing from my office the many much appreciated cards I received at Christmas. Some were more difficult to part with than others—most of all, perhaps, this one from the London School of Flying, Elstree.

THE INDUSTRY

Aircraft Industry Employment

DURING October last year the number of people employed on "aircraft manufacturing and repairing" in the United Kingdom rose by 2,100—the largest monthly increase for more than four years—to 285,600. This total compared with 283,500 in September and 281,700 in August, and with the October 1959 figure of 278,600.

A peak post-war employment level of 265,000 was reached in January 1957, this total being computed on a different basis to that of the 1960 figures. From then until August 1959, the industry's labour force decreased to 235,200 (or 279,400 by the new system of reckoning); and apart from fluctuations of a few hundred, the monthly figure has remained constant until July last year, since when there has been an increase of 5,400. The October 1960 figure (285,600) is roughly equivalent to 241,500 by the old system of computing, indicating that in a period of 3¾ years (since January 1957) there has been a reduction of some 23,500, or nine per cent.

The SBAC president, Sir George Dowty, said in a recent interview with Mr Frank Beswick (*Flight*, January 6) that he did not expect "any substantial change" in the aircraft industry employment situation "over, say, the next two years."

English Electric Plastics

A NEW reinforced-plastics division has been formed by the English Electric Co Ltd. Its address is The English Electric Co Ltd, Reinforced Plastics Division, Freckleton Works, Mill Lane, Warton, Lancs (Freckleton 521), and reinforced-plastics work of the group will be centred at these works. The division, which has had long experience in the manufacture of aircraft components at Preston, will concentrate on twelve of the fifteen processes accepted in reinforced plastics. Manager of the division is Mr Charles Hayes.

German Spraymat Manufacture

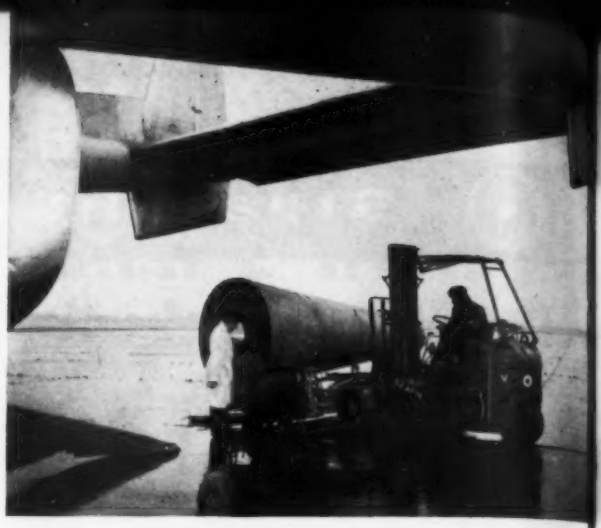
BY a recent agreement, Westfalische Metall Industrie KG, Hueck & Co, of Lippstadt, have acquired the exclusive right to manufacture and sell Napier Spraymat electrical de-icing systems throughout West Germany. D. Napier & Son Ltd are to supply all necessary drawings, reports, technical information and assistance, while in return WMI will in due course make available to Napier details of any refinements and improvements which may result from their development of the system.

WMI production personnel are at present undergoing training at Napier's Luton factory, and full-scale production of Spraymat is due to start at Lippstadt in May next year. The German company's initial task will be to equip the Lockheed F-104G Starfighters being built in Germany for the Dutch, Belgian and German air forces. Spraymat is also on order for the wings and tailplane of the Transall C.160.

Blackburn Developments

IN his New Year message to employees of the Blackburn Group of companies the chairman, Mr A. F. Jopling, said that further expansion of the engine side of the industry was certain and outside companies would have to be called in to help. He added: "the coming year seems certain to see a further increase in activity at Brough. In the Buccaneer, Blackburn Aircraft Ltd has an aircraft of the greatest importance and it is entirely reasonable to predict many years of development and production of this aircraft, apart from other projects which we are studying. Blackburn Engines Ltd has expanded throughout 1960 and the existing and anticipated orders will call for further expansion at Brough and, in addition, for considerable help from outside."

Blackburn Electronics Ltd, the latest Brough offshoot, reports steady expansion and a healthy order-book. News of a production order for a second batch of starter trolleys for use by the RAF was given by Blackburn on January 7. The number involved has not been stated.



One of the Industrial Acoustics Company's multi-jet suppressors ordered by the Royal Norwegian Air Force about to be loaded into a RNoAF C-119 at Northolt for delivery to Stavanger. The suppressor is mounted on a trailer fitted with hydraulic devices, allowing it to be angled into line with the jet orifice and so used for a variety of aircraft. The one illustrated is for use with RF-84Fs, F-86Fs, F-86Ks and T-33s. References to Industrial Acoustics suppressor equipment (in use at Lossiemouth and Prestwick) were made in "Flight" for April 15 and June 3 last year

Appointed chief executive (engineering) responsible for all research and development activities at the Manor Road factory of the de Havilland Aircraft Co Ltd: Dr G. H. Hough, PhD, who since 1959 has been chief engineer in charge of all D.H. air-to-air guided weapon work. The plant, which before the D.H. aircraft and propeller companies amalgamated operated under the name of de Havilland Propellers Ltd, is engaged on air-to-air missiles, propellers, fuel controls and other aircraft equipment

IN BRIEF

Mr W. Spires, ARAeS, MSE, has been appointed to the board of Dowty Rotol Ltd. He joined Dowty in 1935 and was made service manager in 1944.

The new address of Texas Instruments Ltd is Manton Lane, Bedford (Bedford 67466).

Sqn Ldr David Masters, DFC, AFRAeS, until recently senior test pilot for Fairey Aviation at Ringway Airport, Manchester, has been appointed special contracts representative to the Derritron Electronics Group.

Mr T. White Wilson, a director of Plessey International Ltd, has been making an extensive tour of the Union of South Africa and Northern and Southern Rhodesia to further Plessey interests in those areas.

Mr L. W. Tingle, commercial manager of the aviation division of the Dunlop Rubber Co Ltd, recently retired after forty-nine years' service with the company. He was presented with a cheque subscribed for by executives and staff by Mr J. Darby, general manager of the Aviation Division, at a farewell party in his honour.

Mr Stanley H. Goss has been appointed joint managing director, with Mr L. G. Oxford, of Firth Cleveland Instruments Ltd, a member of the Firth Cleveland Group. In January last year Mr Goss was made an assistant managing director of Simmonds Aerocessories Ltd, parent company of Firth Cleveland Instruments Ltd; and he became a director of Firth Cleveland Pumps Ltd when that company joined the Firth Cleveland Group in 1959.

Smiths Aviation Division have received an order for Waymouth fuel-contents measuring equipment for the 24 D.H. Tridents now being built for BEA. As in the case of the Vickers VC10 (for which Smiths received a similar order), the Trident will have a development of the basic Waymouth Type 4 transistorized fuel contents gauge incorporating facilities for the accurate control of fuel load during ground handling. Delivery of the equipment is scheduled to begin early next year.

Services provided by Welding Supervision Ltd and Cathodic Corrosion Control Ltd (wholly owned subsidiaries of Constructors John Brown Ltd) have been amalgamated and will now be provided by a single company, Corrosion & Welding Engineering Ltd, operating from January 1 this year. The directors are Messrs R. M. Wynne-Edwards, C. C. Bates, R. A. Lowe, H. M. Powell, J. A. R. Staniforth and H. D. Walker.

Firth Cleveland Group have acquired the lease of 7 Cleveland Row, St James's, London SW1, a large block adjacent to the group's headquarters at Stornoway House, Cleveland Row. The new offices will be occupied by the home sales divisions of Simmonds Aerocessories Ltd, Firth Cleveland Instruments Ltd and Surform (Firth Cleveland Tools Ltd), and the home and export sales departments of British Lead Mills Ltd, Seculate Ltd and Richard Hill Ltd.

SERVICE AVIATION

Air Force, Naval and Army Flying News

FOA (Home) Appointed

AN officer who won the DSC while serving in HMS *Ajax* as gunnery officer during the Battle of the River Plate is to be the next Flag Officer Air (Home): now Rear Admiral D. P. Dreyer, CB, CBE, DSC, he takes over his new appointment in May, succeeding Vice-Admiral Sir Deric Holland-Martin, KCB, DSO, DSC, who becomes C-in-C, Mediterranean.

Admiral Dreyer is the son of the late Admiral Sir Frederick Dreyer, Beatty's Flag Captain at the Battle of Jutland. Since January last year he has been Flag Officer (Flotillas), Mediterranean, and prior to that was Assistant Chief of Naval Staff. He was made a CBE in 1957 and created a CB in the Birthday Honours of 1960.

Changes of Command

TWO AOC-in-C appointments are announced by the Air Ministry. AVM Sir Leslie Dalton-Morris, KBE, CB, is to be Air Officer Commanding-in-Chief, Maintenance Command, from March 1, with the acting rank of air marshal, in succession to Air Marshal Sir Douglas Jackman, KBE, CB, who will be retiring from the RAF; and AVM W. P. G. Pretty, CB, CBE, is to be Air Officer Commanding-in-Chief, Signals Command, from next June.

AVM Dalton-Morris is the present AOC-in-C Signals Command, having previously been Assistant Chief of the Air Staff (Signals) and before that Chief Signals Officer, Middle East Air Force. AVM Pretty has been Director-General of Organization at the Air Ministry since October 1958, having previously been AOA, 2nd Tactical Air Force.

RAF captains of the Dakotas being used by the Queen and the Duke of Edinburgh on the Nepalese sector of their Asian tour (see "From All Quarters," p 72): Sqn Ldr D. M. Divers (left) and Sqn Ldr P. J. Langley

New Year Moves

CHANGES for two senior RAF officers were announced by the Air Ministry last week: AVM J. F. Hobler is to be AOA, Far East Air Force, from May; and AVM H. J. Kirkpatrick becomes AOC No 25 Group, Flying Training Command, from the beginning of next month.

AVM Hobler, an Australian who transferred from the RAAF to the RAF in 1932, has been AOC No 25 Group since October 1958 and before that was AOA, Middle East Air Force. AVM Kirkpatrick, who won the DFC when commanding No 218 Sqn (Wellingtons) early in the war, has been Chief of Staff, 2nd ATAF, Germany, since August 1957. Previously he was ACAS (Operational Requirements) at the Air Ministry.

Henlow's Diploma Status

A RECENT decision by the National Council for Technological Awards to recognize all technical cadets taking the course at the RAF Technical College, Henlow, as eligible for the Diploma in Technology—equivalent to an honours degree in a British university—has been described by Air Ministry as "the most significant development" in the history of the college. This decision follows visits to Henlow by members of the council; and as a result of it—to quote from a recent Air Ministry news letter—the RAF "becomes the first of the three Services to provide a course for its technical cadets which meets the very high standards of instruction required by the Council for 'dip tech' recognition."

The first cadets to benefit from the change will be those who entered Henlow last autumn. Like subsequent intakes, they will do four years and two terms at the college before taking their end-of-course examinations. Following these, the commandant (in conjunction with an external examiner appointed by the college and approved by the council) will submit to the council his recommendations for the conferment of the Diploma in Technology (Engineering). Eligibility of the Henlow course for continued recognition for the award is to be reviewed by the council every five years.

C/Obs R. C. Mitchell (left) on duty with Obs M. Randall, a new member of No 5 Group, Royal Observer Corps, during a recent exercise. Their post, Alfa Wun, is on the 212ft high tower of London University Senate House

NEWS IN BRIEF

HMS *Ark Royal* is to make a four-day goodwill visit to New York from February 18 to 22.

The Queen and the Duke of Edinburgh are to visit No 1 Initial Training School at RAF South Cerney, Glos, on April 20.

No 3 Sqn, formerly equipped with Javelins, now has Canberra B(I).8s. Its number was taken over in a ceremony at RAF Geilenkirchen, Germany, on January 4 by No 59 Sqn. No 3 is one of the oldest squadrons in the Royal Air Force. It was formed at Farnborough in May 1912 and went to France in August 1914.

It is understood that the New Zealand Government is to make an announcement "very shortly" about the replacement of the 12 Sunderland flying-boats at present operated by the RNZAF. Possible alternatives (*Flight*, October 21 last year, page 656) are the Martin P5M-1 or -2 or the US Navy's MR version of the Lockheed Electra.

No 38 Group Old Comrades Association are holding their 15th annual general meeting and reunion dinner at the Victoria Hotel, Buckingham Palace Road, London SW1, on March 11, 1961, at 6.30 p.m. Tickets (£1 each) may be obtained from the hon secretary, Mrs L. C. Rendall, c/o Bailey's Hotel, Gloucester Road, London SW7.

Gp Capt K. T. Nicklin, OBE, formerly Senior Equipment Staff Officer, MEAF (before taking last year's IDC course), recently became CO at No 16 MU, Stafford, with the acting rank of air commodore.

The badge of No 280 Signals Unit in Cyprus, recently presented to the CO of the Unit, Wg Cdr P. A. Knapton, by AVM J. Worrall, SASO, Middle East Air Force, incorporates a wild cat face, in keeping with the name of Cape Gata, the legendary "cape of cats" in southern Cyprus on which the unit is based.

During the decade just ended, some 2,500 cadets of the Air Training Corps have gained PPLs under the RAF flying scholarship scheme which started in 1950. Since that date, 3,000 ATC cadets have been selected for flying training; and of the 2,500 who qualified for PPLs, 48 per cent later joined the RAF for flying duties.

The RAF Benevolent Fund have received £50 for their residential school, Vanbrugh Castle, Blackheath, from Rolls-Royce Ltd, the donation having been made as an alternative to sending out Christmas cards. Donations for the same reason, but not specifically for the school, have been received by the Fund from the ARB (fifty guineas) and Smiths Aircraft Instruments Ltd (a hundred guineas).

Members of No 1 (County of Hertford) Maritime Headquarters Unit, RAuxAF, at Northolt on their return from a recent weekend training and liaison visit to the French NATO headquarters at Brest. The unit is based at Valency House, Northwood, Middx

The first of TWA's Convair 880s, twenty of which are on order, went into service on January 12. Today, January 20, they are to start daily services between New York and Chicago, connecting with the London service. Initial Convair 880 operators were Delta and, later, Northeast who have six (leased from TWA) in operation

AIR COMMERCE

TAA AND THE CARAVELLE

IT is well known that Trans-Australia Airlines wanted Caravelles and not Electras, and inevitably the airline's director of engineering, Mr John L. Watkins, touched on this subject in the second Sir Charles Kingsford Smith memorial lecture which he gave at Sydney University before the Sydney branch of the Royal Aeronautical Society. "This brilliant French design, which is now being copied so widely by British and American manufacturers," he said, "had been under close study by TAA since mid-1954 when I visited the Toulouse factory—actually the first representative of any airline, other than Air France, to do so. This is the Caravelle which we could, and I believe should, have had in service here by mid-1959."

Looking ahead, Mr Watkins said that 1963-64 "should see the introduction of the first domestic pure jets in Australia, in the 120,000lb size class, and possibly 1965-66 will see the small Viscount replacements appearing without propellers." Referring to the Caravelle, he noted that there are variants based on high-by-pass ratio fan-type engines, both Rolls-Royce and GE. "The specific economy of these remains highly competitive down to stage distances as short as 350-400 miles, and a version of this design could even now prove to be the optimum choice for the next phase of our fleet equipment."

Talking about the development of VTOL aircraft Mr Watkins remarked that "enthusiasts see in these vehicles the means for slashing the time occupied in getting from the city centre to the airport. This is a very laudable objective, but I cannot help feeling that it is likely to be more economically tackled, overall, by a substantial investment in well-engineered limited-access roads to speed up surface transport, to the benefit of all road traffic, rather than by the development of exotic and complex aircraft." He thought we must be "very cautious" about basing any large-scale plans on "vehicles which don't measure up to the same sort of standard of basic efficiency measured in production of ton-miles of revenue potential against pounds of fuel burned. And you don't produce any ton-miles at all by a vertical take-off and hover, but you're liable to burn an awful lot of fuel doing it." Even the helicopter's best friends could not claim that it was an efficient transport vehicle for going from A to B by comparison with fixed-wing aircraft. He feared personally that direct lift-off, or anything like it, was likely to remain a pretty expensive luxury. In his view the hovercraft must make its own way in economic competition, not with aircraft, but with boats and trucks.

MACH 3 IS A NATURAL

"IMMEDIATE establishment of a national programme for the development of a commercial supersonic transport" should be given "prompt and careful consideration" by the US Government. This is recommended by Mr E. R. Quesada, administrator of the FAA, in a study prepared by that agency. This concludes that a Mach 3 transport "can and should be built by the US industry with Government financial support."

According to Mr Quesada, "the supersonic transport is inevitable. The dynamic nature of aviation demands constant progress—a Mach 3 transport is the next natural step. Some nation will build this airplane. If we are to move ahead in the 1960s this nation, with its military and civil experience in producing the world's finest aircraft, must give serious consideration to this programme now and take the indicated initiative without further delay."

FOCUS ON SAFETY

REVIEWING recently the Ministry of Aviation's somewhat superannuated Survey of Accidents for 1958 (*Flight*, January 6), we suggested that what is most needed is the prompt and regular publication of lessons learned from air accidents. The chairman of the Transport Flight Safety Committee, Mr J. W. Gibbs, now sends us the following note:—

"You will remember that in 1959 the then Minister of Transport and Civil Aviation announced the setting up of a Transport Flight Safety Committee, consisting of representatives of operators, the ARB and the civil and service Ministries. Our main task was 'to consider common problems of flight safety organization, to agree systems for the collection, analysis and exchange of information, and to advise on safety publicity within the industry.' The committee started work in October 1959.

"From the beginning we realized the importance of the collection and dissemination of information and lessons learned from incidents and accidents, not only in this country but also from world-wide sources. It has been possible, by voluntary effort of the members, to collect and disseminate information by means of a bulletin called *Flight Safety Focus*. This has been distributed in the United Kingdom, but for financial reasons the circulation has been limited. Up to the present seven issues of *Focus* have been produced; it has received an extremely favourable reaction from the recipients, and there have been increasing demands, not only for extra copies, but also for a wider circulation. Efforts are being made to get firm financial support for this work—if this is successful continued publication will be assured, distribution can be expanded and some improvement in presentation will be possible.

"The knowledge that the work we are doing has support in the aviation press is most encouraging."

Focus was obviously an excellent move in the right direction, and of course the columns of *Flight* are always open for the dissemination of information about safety. Perhaps in due course

While Electras of the British Hong Kong based airline Cathay Pacific are at Lockheed for modification, the airline has chartered a Britannia 102 from BOAC to maintain services on the Hong Kong - Singapore - Manila - Sydney route. The aircraft, seen here in its temporary livery at Sydney, is G-ANBO

Some indication of the effort that went into moving the BOAC 707 that suffered a landing mishap at London Airport on December 24 is evident from this picture. The aircraft was moved across more than 3,000 sleepers to the BOAC maintenance base, where it is now being repaired. Boeing are sending a team of 40 engineers to assist

the aviation Press will be included among the recipients of *Focus;* it certainly seems a pity that the TFSC's budget should be restricting the wider circulation of this publication.

THE SLUSH BOGEY

AIRCRAFT with bogie undercarriages are in general markedly less affected by slush than comparable types with other wheel configurations. This thought for aircraft designers—especially for those planning new transports with dual wheels only—emerges from a passage in *Civil Aviation Information Circular No 8* just published by the Ministry of Aviation. Appearing in time for the slush season, it is intended for airline operators, and it frankly admits that the deterioration of take-off performance in slush "is greater than has been generally appreciated."

There are some signs, indeed, that the circular has been rather hurriedly prepared: for example, the word "bogie" is spelt—perhaps appropriately—"bogey"; but more serious is the fact that the vital table erroneously transcribes 1.0 inch of slush as 0.1in. A footnote to this table, too, is obviously wrong. Nevertheless, the circular is a valuable contribution to safety and is mandatory reading for all airline operations personnel.

The thoughts of those who read it will turn to Capt James Thain, the BEA pilot-in-command of the Ambassador which crashed—probably in some measure owing to the effects of slush—on take-off at Munich in February 1958. Though he has lost his job (actually for not having ensured that his wing was clear of snow before the fateful take-off), he must nevertheless feel that the long fight to clear his name has not been in vain. It is probably true to say that, had Capt Thain not survived, the very real dangers of slush (and water), now formally acknowledged by the Ministry in this circular, might not have been recognized as soon as they have been.

It will be seen from the table, which is reproduced from the circular, that the Ambassador is the most sensitive to slush and water. This is probably because it is a high-wing aircraft, and secondary drag (i.e., additional to that experienced by the wheels) arises from the spray striking the slow-slung fuselage.

Aircraft type	Percentage increase to take-off* required for depths of slush or water	
	½in	1in
Boeing 707-436	10	30
Comet 4	10	25
Ambassador	40	—†
Argonaut	30	80
Britannia	10	30
Constellation 749	30	80
DC-3	20	50
DC-4	30	80
DC-6	30	80
DC-7C	30	80
Bristol 170 Freighter	20	50
Hermes	30	80
President	30	—†
Prince	30	—†
Viscount	30	80
Vanguard	15	40
Viking	20	50

* Flight manual take-off field length. † Take-off not recommended.

Saying farewell at Renton to Mr Ivor Lusty, BOAC's West Coast technical consultant and Boeing plant representative, is Mr T. Gillan, BOAC's senior inspector of the acceptance group. The occasion was the departure for London of BOAC's 15th aircraft. Although deliveries are now complete Mr Lusty is to remain at Renton to study technical developments and to look after the supply of spares

SUPERSONICS AND AUTOMATIC LANDING

THE following letter from Capt A. P. W. Cane of BOAC reached us too late for inclusion in the correspondence pages of this issue. In view of its importance it is reproduced in full here. The letter concerns a contributor's report on the recent RAeS supersonic transport symposium on December 8:—

"In view of the fact that I am at present involved with a future aircraft in which it is the intention to incorporate, ultimately, full auto-land facilities, I must request that you correct some remarks wrongly attributed to me. On page 1025 of your issue of December 30 your contributor credits me with being 'sceptical of auto-landing' in a question that I put to Capt Ormonroyd at the RAeS Supersonic Symposium. In fact the question was:—

"In view of the requirement for supersonic operations on a *world-wide* basis and the improbability at many aerodromes of achieving adequate ground facilities, had the speaker any views on the manual approach and landing capabilities of supersonic airliners?

"One thing is fairly certain in the field of automatic landings and this is that as long as their success depends partially on the provision of ground-based facilities, then their introduction on a world-wide basis will inevitably be a very slow process. Hence the requirement for adequate manual approach and landing capabilities in supersonic airliners. Unless the auto-landing system is to be *fully* self-contained in the aircraft, without the necessity for ground based aids—an unlikely solution—then not even a plethora of autopilots will completely solve the problem. It would appear that the only difference of opinion between Capt Ormonroyd of BEA and myself is the sphere of operation of our respective airlines: there is a possibility of achieving adequate ground facilities in the foreseeable future in Europe, but not on a world-wide basis.

"In conclusion I would like to emphasize that for some years now I have been an advocate of automatic landing."

TAP FINDS A WAY

IT is easy to be critical of a small airline that takes over nine months to hatch its annual report when some of the world's largest carriers have compressed the gestation period into three months. But this is to overlook the fact that many of the big companies can afford to employ staff who are wholly devoted to the preparation of the annual report and accounts; this is one of the economies of large scale that is denied to small airlines such as Portugal's national carrier, TAP.

Accepting the antiquity of this company's latest annual report as an unavoidable diseconomy of small scale, it must be stressed that this particular report for the year 1959 is one of the best of those that have flowed in a steady stream into *Flight*'s offices during the past nine months. Particularly valuable is the comprehensive and frank way in which it fills in the historical and political background against which the year unfolded.

The most striking item in the report comes in the form of a reminder that TAP is by international standards a very small company: annual revenues, which include a modest element of subsidy, came to only slightly over the equivalent of £3m in 1959, while total staff numbered but a few over 1,000. Contrary to

AIR COMMERCE . . .

popular belief, TAP is also a low-cost operator, the 1959 accounts showing cost levels of 31 and 35 pence per c.t.m., depending on whether or not depreciation is taken into account. The reason is that the airline is primarily a long-haul operator with an average passenger-haul of over 1,000 miles. Indeed, out of total traffic revenues in 1959 of Escudos 236 million, the transcontinental African routes yielded Escudos 155m. On these long routes the average revenue rates were poor (only 54 pence per l.t.m. as against 71 pence on the European network) and load factors fairly low at about 60 per cent. Add to this a low route density operated with Super Constellations, and it is not surprising that the African routes show a deficit.

Although the European routes also show a loss, circumstances here are quite different. In this case the problem is fundamentally one of absurdly low load-factors—in the region of 35-40 per cent—which result from uncompetitive aircraft and inadequate salesmanship. During 1959 TAP took a major step forward to overcome this problem by entering into a pool agreement with BEA, involving the charter of BEA Viscounts. This has not only converted the London service into a strikingly profitable operation, but it has also triggered off such a sharp growth of traffic that London is now easily the most important non-African point on TAP's foreign network. It will be interesting to see how the company now goes about eliminating the losses on the highly uneconomical Paris services.

Appointed British United Airways' general manager, flight operations on January 1, Capt E. N. Jennings was made MBE on the same day

IMBROGLIO FIUMICINO—THE FEATHERS FLY

ALMOST every major Italian newspaper with any claim to a public conscience is now well launched in an exposure of a grand scandal concerning Rome's new Leonardo da Vinci airport at Fiumicino. Even allowing for the political capital which a paper can obviously make from the supposed mismanagement of such a national and international project, there seems to be some basis for concern. First of all, the cost of the airport and its installations, when completed, has been reported to amount to at least $50 million, or about £18 million. Secondly, the original project, drawn up with the advice and agreement of potential operators and airport experts, was scrapped in favour of one produced by a group of architects inexperienced in aviation under contract to the Ministry of Public Works. Thirdly, the airport was built on land which the experts agreed was unsuitable—it is described as "an unstable pile of gravel over a quagmire"—and much additional expenditure has resulted from repeated changes in installations and improvement of foundations resulting from the above factors. That the land was otherwise useless and bought from the head of a powerful Roman family and that certain monopoly agreements and working arrangements were concluded only adds to the air of scandal and may or may not be true.

Scandals apart, there are certain operational aspects of the new airport which may raise some difficulties. A major one is that Fiumicino is in line with, and only 11 miles from, Pratica di Mare, the Italian experimental airfield and base of a fighter-bomber wing. It is also reported that the special road and rail links with Rome, 15 miles away, have not been completed. Offices for airline companies, except Alitalia, were not originally provided and have been installed under the terminal roof where summer temperatures exceed blood-heat in day-time. The metal and glass roof has partially given way and has had to be extensively rebuilt. The canopy over the vehicle-access way was too low and has had to be raised to accommodate buses. Sloping passenger walkways are unsuitable and there are no separate channels for arriving and departing passengers. One of the two runways is unusable because of subsidence over one-third of its length and the other has already been resurfaced three times for the same reason, but shows no signs of ceasing to subside. The control tower has been wrongly laid out and is unusable. A temporary tower is being built. Fuel storage is sufficient for only 48 hours and access for the necessary number of road tankers is inadequate. Only one hangar has been provided and that is reserved for Alitalia. Other operators have clubbed together and are already paying for facilities which are indeterminate and for which no completion date has been given.

The Italians are rightly concerned at the unfortunate impression this state of affairs could make abroad, particularly where it concerns excessive charges and restrictive regulations to operators. The possibility of a reduction in the standard of safety must also be seriously considered.

Offshore Aviation, an Autair associate, have recently purchased two Bell helicopters from Agusta of Milan, where a production line is well established. One is a Bell 47 J2, seen here completing acceptance trials; the other is a Bell 47 G3. After delivery both were flown in Autair's DC-3 to start operations in Central Africa

NEW CUNARDERS TO NEW YORK

APPROPRIATELY enough, the very first application lodged with the new ATLB was for a licence to operate on the world's most important international route—London - New York. Appropriately, too, the pioneer applicant was Cunard Eagle Airways. The application was due to be published last Wednesday, January 18.

The application covers passengers, mail and freight, and it specifies the use of Britannias initially and big jets later; Cunard Eagle evidently has an open mind on which particular type of jet, because the application specifies "any one" of the following types: DC-8, Boeing 707, VC10 or Super VC10.

The destinations listed, in addition to New York, are Montreal and Toronto in Canada, and Chicago, Detroit, Philadelphia, Washington, Baltimore and Boston—in other words, all the eastern US points defined in the US - UK air agreement. Points in the UK are London, Manchester or Prestwick (or all these).

It was, of course, inevitable that Cunard Eagle would file an early application for the North Atlantic route. The implications, including speculation about the possibility of a pool with BOAC, were reviewed in *Flight* for September 23, pages 517-518.

Eagle already have UK approval for an all-freight service across the North Atlantic: all they are waiting for is the necessary US visa—namely, a CAB foreign-carrier permit. Will such a permit be forthcoming for the passenger services just applied for? Assuming that Eagle convince our own Board (in the face of BOAC's inevitable opposition) that they should be licensed, they have still to obtain the necessary US foreign-carrier permit. But, unlike so many of British United Airways' recent applications (see last week's issue), this one from Eagle cannot be killed by the Ministry of Aviation on the grounds that it is likely to call for tricky traffic-rights negotiations. The US - UK air agreement has no capacity

This is Rome's Leonardo da Vinci airport at Fiumicino, shortly before its inauguration on January 15. Seen here is the 40ft high statue of the great painter and scientist, centre is a view of the runways and airport buildings and on the right is an impression of the interior. In these photographs Fiumicino looks gracious enough, but in Italy a storm is raging over its construction—see story in col 1

or frequency limitations, and no limitations as to the number of carriers that may be designated on any route. There are, of course, already three US scheduled carriers on London - New York (Pan American, TWA and Seaboard and Western) compared with the one British carrier, BOAC. And Cunard Eagle have two strong traffic bargaining counters in Bermuda and the Bahamas, where they are well established, and which are heavily frequented by PanAm, Eastern and Mackey services flying tourists to these British territories. Finally, there is the pull of the name Cunard which, when it comes to bargaining for trading rights in America, will not be unhelpful.

Cunard Eagle have also filed applications to serve many of the European points applied for by British United, indicating that there has been no behind-the-scenes gentlemen's agreement as to which places will be applied for by which of the two leading independents. Cunard Eagle evidently do not intend to concede Europe to BUA.

Footnote: Edition No 1 of the Air Transport Licensing Board's *Civil Aviation Licensing Notices* appeared on January 11, listing the BUA applications reviewed last week (the earlier Cunard Eagle application having been held over, for clerical reasons, until Edition No 2, due to be published last Wednesday). Two interesting new points emerged: BUA specifies the eventual use of Tridents or VC10s, and quotes fares for domestic routes that are higher than BEA's first-class fares and roughly the same as the corporation's tourist tariff.

SHOOFNER AIRLINES GET FIRST AIR OPERATOR'S CERTIFICATE

USED by the Director of Aviation Safety, Ministry of Aviation, to illustrate the requirements of the air operator's certificate, the name "Shoofner Airlines Ltd" appears on specimen certificates accompanying *Notes for the Guidance and Information of Applicants for an Air Operator's Certificate*, just issued by the MoA.

The *Notes*, which have no legal force, are a detailed amplification of the requirements of the Air Navigation Order 1960 as they affect operators of public transport aircraft of over 5,000lb a.u.w. Operating agencies in this category, it will be recalled, must from March 30 hold an air operator's certificate.

Broadly, before a certificate can be issued, an operator's organization must be surveyed by the ARB (who are responsible to the Director for all engineering matters), and must have operating standards, organization and facilities inspected by the Ministry's flight operations inspectorate; and a Ministry training inspector must examine the adequacy of training arrangements.

Flight operations inspectors will, from time to time, fly in all operators' aircraft in the course of normal operations, but it is hoped to avoid a furore similar to that which occurred between airline pilots and FAA inspectors in the United States by limiting the concern of Ministry inspection personnel to standards of safety and facilities. Professional skill of the crew is not their responsibility. Inspectors have the authority to board and fly in any aircraft at any time, and to enter and remain on the flight deck. Only if the aircraft commander considers that the safety of the aircraft would be endangered can entry be refused.

Compulsory reading for any applicant for an operator's certificate, the *Notes* include sections dealing with operations manuals, aircraft loading, flying-staff records and organization. They are most comprehensive—no fewer than six foolscap pages, for example, being devoted to the requirements of the Director of Aviation Safety in respect of operations manuals. Some of the salient points are picked out below.

Copies of all operations manuals and all amendments must be lodged with the Director. It is not essential that a manual shall be confined to one volume, since it may be advantageous to separate the subject-matter into parts that relate to, say, duties of cabin staff, base operations officers, and so on.

Flight time and duty periods will now have to be set out by each operator. It is no longer sufficient to refer to Air Navigation Regulations; the limitations must be specified in detail. They should include the time at which crews are to report for flying duty, give maximum duty periods and allow a reasonable period for pre-flight action.

Technical information in considerable detail must be included in the flight manual. The *Notes* list the requirements and also the information required about operations in special conditions. This includes operation from wet, icy, snowy or slush-covered runways, for which specific limits must be laid down (see note on page 97). Crosswind limits must be specified. It is not sufficient to say that a particular crosswind component has been found to be acceptable; limitations must be stated in unequivocal terms and the question of gusts, surface conditions and technique satisfactorily dealt with. Fuel-allowance formulae must similarly be given in detail, for instance on the way that consumption is affected with two power units inoperative, or where a loss of pressurization has occurred. There is no objection to an operator permitting flights on selected routes when the fuel carried falls short of the normal minimum, the *Notes* advise, provided that at any stage of the flight the fuel remaining is sufficient to continue to a suitable aerodrome for landing, *then* to divert to an alternate *and* to hold for 45min with an allowance for contingencies.

More logical loading, weight and balance arrangements should follow the issue of the *Notes*. It is now mandatory, for example, to show on the load and trim sheet that the c.g. lies within permissible limits, and the load sheet must show when average weights have been used. A special section deals with car ferry operations, for which there is an instruction to the effect that a special traffic manual must be provided which gives explicit directions on the checking of baggage weight in vehicles; checking of petrol tanks; lashing of vehicles, and the procedure to be adopted when a vehicle does not appear in the list of kerb weights. All of these points are, in fact, covered by the two present operators.

In the section dealing with flying-staff records a reminder is given that checks of pilot competency must include a twice-yearly check of ability to perform asymmetric manoeuvres on instruments, unless only VMC operations are intended. Checks on procedures in emergencies such as an engine fire, propeller overspeeding, engine failure before V_1, and so on, may be conducted in a flight simulator. This must be representative but checks on aircraft commanders ability to use approach-to-land systems may be conducted on flight trainers or Link trainers.

In a small undertaking the chief pilot is expected to know in detail the general competence of each of his pilots and to arrange for special route training; in larger organizations a system of control not depending on personal knowledge will be necessary.

Finally, the *Notes* demand "full information" from the applicant. Operators must provide a list of managerial and key executive staff along with a statement of how duties and responsibilities are allocated, but the Director will concern himself with other personnel only if the number employed appears inadequate for the type and extent of the operations undertaken.

All in all, and as expected, an air operator's certificate demands much preparatory work in the regulatory and managerial aspects of airline operation. Shoofner Airlines have set a high standard of competency for others to follow.

AIR COMMERCE . . .

AMERICAN'S SHORT-RANGE JET

THERE are four major domestic operators in the United States —United, Eastern, TWA and American Airlines. Of the four, United and Eastern have recently placed orders for short-range jets (40 Boeing 727s each), American has yet to do so and TWA, though obviously concerned about replacements for its 30 Martin 4-0-4s, is unlikely to be able to finance a small-jet fleet so soon after its struggle to find money for Convair 880s.

What will American Airlines buy? When Boeing were conducting market studies for the 727, it was found (*Flight*, December 30) that Eastern and United's ideas were fairly closely aligned, while American's needs were rather different. The last-named is not averse to three engines—although 18 months ago, when the Boeing survey was conducted, two would perhaps have been preferred—but American would not, on operating-cost grounds, accept four. American are also said to require a slightly smaller aircraft than do Eastern and United. They asked for internal dimensions giving room for, say, 64 all-first-class seats instead of 68. In tourist-class terms this would be about 106 seats six-abreast against 114. This is a rather larger capacity than is available in the Caravelle 7 (maximum 89 passengers), but not much more than that offered in the 100-seat Trident. American has expressed interest in both these aircraft and de Havilland teams have visited the airline.

One reason for American's interest in the Trident must be delivery dates; the first of 24 aircraft should be delivered to BEA in "mid-1963," and the first of 40 727s to Eastern at the beginning of 1964. This lead is accepted by Boeing, who "would not be surprised" to see the Trident certificated before their own 727. While United and Eastern are unlikely to concede places on the Boeing production line to American, in deference to export orders BEA might conceivably do so with the Trident.

It is interesting also to speculate, with this order in the offing, how hard automatic landing is being pressed as an outstanding advantage of the Trident. In this connection a contract has recently been signed by the FAA for the supply of automatic landing equipment manufactured by Smiths and Murphy Radio for installation in a DC-7C. The work will be carried out by the Sperry Gyroscope Co of America, and this British automatic landing system will be evaluated at Atlantic City.

BOAC's WESTERN SALES

THOUGH much more than half BOAC's output is now on the western routes (the proportion is 53 per cent compared with 48 per cent in 1959), there still appears to be a disturbing shortfall in traffic on these routes. Analysis of figures just published by the Ministry of Aviation shows that in the twelve months ending October 1960 only just over half the capacity offered by BOAC on western routes was sold. The overall load factor was 51.4 per cent, compared with nearly 65 per cent on the corporation's eastern routes.

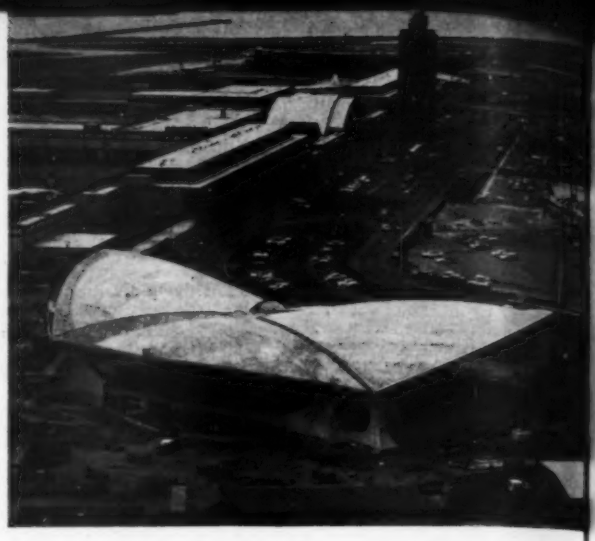
Thus though more than half BOAC's effort now goes into the western area, more than half the traffic still comes from the east.

One of the reasons for this is the big freight-hold capacity of the Boeing 707, but BOAC's efforts to fill these holds are evident from the fact that western freight traffic went up 48 per cent in the year ending October 1960. By comparison eastern freight traffic *fell* by nearly 17 per cent—the only "negative increase" occurring in a boom year for BOAC.

In the year ending October 1960, total load ton-miles on all BOAC services increased by 24.5 per cent, passenger-miles increasing by more than 28 per cent. Overall load factor on all services just about held its own at 57.7 per cent.

So far as BEA are concerned, by far the biggest increases in traffic occurred on domestic routes during the year ending October 1960. Total load ton-miles went up more than 29 per cent, the domestic load factor of 68.5 per cent being two points higher than in the previous year.

Footnote: According to a provisional MoA estimate released last week, UK scheduled air traffic as a whole increased by 23 per cent in the calendar year 1960. Capacity offered went up by 25 per cent, so that overall load factor fell by one percentage point to 61 per cent.



This air-to-ground shot of New York International shows the position of TWA's remarkable new terminal in relation to the rest of the main arrivals and departure building. In the background, beyond the control tower, may be seen the rather more conventional Pan American terminal

HEATHROW AIRPORT

LONDON (Heathrow) Airport is to be the new name for London Airport, the Minister of Aviation, Mr Peter Thorneycroft, has decided. Gatwick is to be known as London (Gatwick) Airport, both changes being made as a result of "the growth of airport traffic at London Airports and their increasing interdependence." The new names will be effective from April 1 this year; call-signs are unaffected.

FINNAIR AND ALCOHOL

A PARTICULARLY unpleasant after-taste to the sad news of Finnair's DC-3 accident on January 3 has been left by a report that the pilot and co-pilot may have been under the influence of alcohol when the crash occurred. The head of the investigating commission said subsequently that drink was probably not the reason for the crash although it was said that both pilots had been drinking the night before the flight. The commission has also noted that the start of the flight was 16min late (although the reason was not stated) and that the pilot had reported the wrong altitude to Vaasa and had apparently flown under the safety limit of 1,500ft for some time.

As a result of the accident, it is to be made illegal in Finland for any aircraft crew member of any airline to attempt to operate after drinking. A law to this effect was to be presented to the Finnish parliament this week.

BREVITIES

United Arab Airlines have placed a repeat order for two Comet 4Cs, for delivery this summer, as forecast in *Flight* for November 25. This brings the UAR order to five, and total Comet orders to 62.

Responsibility for the issue and distribution of Ministry of Aviation *Civil Aviation Information Circulars* has been transferred, as from January 12, to the Aeronautical Information Service, Tolcarne Drive, Pinner, Middx.

The South African Airways Boeing 707 which crash-landed at Embakasi Airport, Nairobi, on October 30 was test-flown on January 8 by SAA's chief pilot, Capt Botes after repairs said to have cost £750,000. The Boeing left for Johannesburg on January 10.

In an accident to an Il-14 of CSA which crashed while taking off from Ruzyne Airport, near Prague, on January 2, ten people were killed, five of whom were members of the crew. All were CSA personnel. The aircraft was on a test flight from Prague Airport.

According to figures recently released by the FAA the US domestic accident rate in 1960 was 1.0 per 100m passenger miles—the highest since 1952. In 1959 the rate was 0.7, the increase in 1960 being attributed to the DC-8-Constellation collision over New York in December. It is estimated that during the year 56.5m passengers travelled by US domestic airlines.

KLM is reported to have ordered one additional DC-8, bringing the fleet up to thirteen.

The FAA has, after a protracted period of testing, approved Fairchild F-27 wings as fully fail-safe. Life of the fuselage has also been increased, to 40,000 hours.

Channel Air Bridge say that since their announcement that off-season rates were to be extended and peak fares were abolished reservations have increased by more than 300 per cent.

At a meeting of the Court of the Guild of Air Pilots and Air Navigators on January 5 Mrs F. H. Brackley, Gp Capt G. F. K. Donaldson, Capt Alan Duckworth, Air Cdre Sir Edward Fielden, Air Chief Marshal Sir Leslie Hollinghurst, Capt V. A. M. Hunt and Capt B. A. Powell were invested with the Livery.

Two Sikorsky C-62 ten-seat single-T58 amphibious helicopters have been ordered by a new US helicopter operator, San Francisco - Oakland Helicopter Airlines, who are to inaugurate services on April 1. The aircraft have been acquired by means of a lease purchase agreement with Sikorsky for delivery in March and April, with an option on a third in three to six months afterwards. A 28-passenger S-61L will be bought when traffic justifies it.

Correspondence

The Editor of "Flight" is not necessarily in agreement with the views expressed by correspondents in these columns. Names and addresses of writers, not for publication in detail, must in all cases accompany letters.

Using a Six-letter Word

THE correspondence published in the January 6 issue of *Flight* between Lord Brabazon and Sir William Hildred shows that safety in airline operation has at last been discussed in front of the general public—the people, in fact, who pay for the not-inexpensive IATA organization.

I have no wish to join in the controversy about JP.4—already being handled efficiently without amateur assistance to cloud the issue—but I do feel that this could be the breakthrough in the matter of public discussion, by the airlines themselves, on matters affecting the safety or otherwise of civil flying.

For several years—as you, sir, are well aware—I handled press relations for more than one airline. At no time was I ever permitted to refer to safety, on the highly dubious premise that this word automatically made the reader think of danger. Frankly, I have never heard such arrant, ill-informed nonsense. Does every car manufacturer eschew this dirty word because it might make the potential buyer assume that his new vehicle will probably kill him? Are passengers diverted from the railways because their operators announce from time to time how safe it is to travel that way?

Self-preservation is the first law of life and the use of rearward-facing seats because they are safer will attract passengers to the line which is courageous enough to announce that they are being used because they reduce the already small risk of flying still further. Safety awards are given to bus drivers. Does the travelling public refuse to be driven by that company? Of course it doesn't. The late C. G. Grey had a creed which he recited in and out of season: "Aeroplanes must land slowly and not burn up." Perhaps we did get a little fed up with seeing it so often, but I have yet to hear of anyone who disagreed with his views or his public statement of them.

The popular press is, of course, not helpful in this matter. Their job is to provide news, sensational if possible, and one can't complain if they do so. But it would not hurt anyone if they added a statement to their report of an accident that so-and-so airline had flown XYZ millions of passenger miles since its last accident. This would not destroy the sensationalism of the basic story, but it would put it into its true perspective.

Airline passenger capacity has grown immensely since the big jets arrived and sales managers have a very large job selling the seats. May I suggest that they should try using this vital aspect of attraction? D. H. Lawrence got away with the use of several four-letter words; perhaps the airlines could experiment with one six-letter word.

A friend to whom I have shown this letter points out that very many passengers are more concerned with speed, cost and comfort than safety. I agree; but the fact that an aircraft or an airline is known to have a high safety-factor won't discourage those passengers. It will, however, attract some who are currently nervous.

In the meantime let us hope that Lord Brabazon and other influential men in public life will keep at it. If they only bring out for all to see what the airlines try so hard to hide, the fact that flying is one of the safest means of transport, they will deserve well of us.

Thames Ditton, Surrey BASIL CLARKE

Club Flying in Iran

MEMBERS of the Iranian Civil Aviation Club were very interested to read the article by Mr David Lomax entitled "Auster to Everest" which you printed in your issue of December 2. In particular we appreciated the experiences of the group in flying light aircraft in the Persian Gulf area. Like our neighbours in Kuwait we operate a club for instructional and sports flying. In our case we also operate regular scheduled postal services to the towns in the south of Persia. Our aircraft strength at present amounts to three Austers, five Tri-Pacers and a Twin Pioneer. We are now anxiously awaiting our first Chipmunk.

One of our mail routes is from Abadan down the east side of the Gulf to Chabahar, and thence inland to Zahedan. We fly the circuit Abadan - Zahedan - Abadan twice weekly. One of the calls on this route is at Jask, where Mr Lomax landed. The "postal Tri-Pacer" to which he refers is ours and in fact it lands at Jask four times a week.

Weather conditions are indeed severe in summer. Temperatures of 125° are common, and there is much dust with strong winds over the Khusestan area. Humidity is usually low but reaches 90 per cent sometimes. I am enclosing a few photographs [one of which is reproduced herewith.—Ed] of some of our light aircraft which were taken during weekend flights last summer.

In conclusion we would like to congratulate Mr Lomax and his crew on a very creditable achievement.

Abadan, South Iran H. E. MARTIN-LEAKE
Secretary, Iranian Civil Aviation Club

Tri-Pacers of the Iranian Civil Aviation Club, seen on the Isle of Kharg, Persian Gulf (letter from Mr H. E. Martin-Leake)

Renfrew Replacement

I FEEL I must draw attention to an incorrect statement in Mr J. D. Gillies' letter in *Flight* for January 6. It certainly is not true to say, as he does, that apart from two small shipyards there is hardly any industry within a ten-mile radius of Prestwick.

The adjoining town of Ayr may be concerned mainly with agriculture (although it keeps its 45,000 inhabitants employed). However, my own town, Kilmarnock, eight miles away, boasts several large firms manufacturing hydraulic machinery, carpets, shoes, railway locomotives and plain bearings (not to mention whisky), to name only a few products. Incidentally, every one of the firms concerned is, I believe, larger than either of the shipyards.

In any case, has Mr Gillies never heard of Scottish Aviation Ltd, who manufacture and overhaul aircraft at Prestwick Airport?

Having said this, I completely fail to see any correlation between the density of local manufacturing industry and the usefulness of an airport; surely the density of population is a more important criterion. What really matters is that the travelling time from Prestwick to Glasgow by diesel train is liable to be a dependable 35 minutes—I challenge Mr Gillies to prove that a time of 16 minutes from Abbotsinch to Glasgow can be *consistently* attained. His point about incompatibility of long-haul and short-haul traffic surely applies only to extremely busy airports such as London, if at all.

Let us hope that Mr Gillies gets his club airport. Then perhaps he will appreciate the very real problem of fog, and poor visibility generally, which forced Glasgow University Air Squadron to transfer its Chipmunks from Abbotsinch to Perth some years ago. Members of this unit now consider the disadvantages of a *two-hour* train journey to be considerably outweighed by the superior weather factor.

Kilmarnock, Ayrshire A. J. DOUGLAS

AS I write this letter, BEA and other aircraft are diverting into Prestwick Airport due to fog at Glasgow (Renfrew Airport). The latter has now been virtually closed for three successive days and in this month alone there have been diversions from it on seven days out of 15, not to mention days on which aircraft were operating into it in marginal conditions. A similar history of disruption of services can be found, taken over the years. Now that it has been deemed incapable of further development, the Government propose to create virtually a new domestic airport in replacement of it at RNAS Abbotsinch only two miles away, which is subject to similar weather conditions, has the same cross-wind problems as Renfrew due to the shortness of the subsidiary runway and is also close to built-up areas. What improvements then are to be gained for an outlay variously estimated at between £1½m and £3m? So far as can be ascertained from the technical information issued, it would boil down to some 600ft additional take-off and 200ft landing run, with little prospect of further extension.

I hope that this small return for a considerable expenditure will not escape the notice of the sub-committee of the Commons Select Committee on Estimates appointed to examine the proposed 1960-61 expenditure on British airports, particularly as it must be viewed against an operating loss of £6m at State airports and the fact that the other airport serving the Glasgow area, Prestwick, which is already developed and equipped as an international airport capable of handling any type of civil aircraft flying or envisaged and with a proven availability record of 364 days in the year, is standing under-utilized, mainly because of a Ministry

CORRESPONDENCE . . .

of Aviation policy which seems to reserve it almost exclusively for transatlantic operations. Such divorcement of international and domestic routes must be without parallel in the world and is hardly conducive to economic airport management or to the proper and natural development of air transport.

The only argument levelled against the use of Prestwick for domestic services is its distance from Glasgow (29 miles); but in doing so its principal critics, BEA and business circles in Glasgow, put an unfair interpretation on this, as the proper criterion is obviously ground journey time to the airport. The new Prestwick terminal building, already budgetted for and in replacement of existing wartime hutted accommodation will, like Gatwick's, adjoin a main railway line giving a journey time of from 35 to 45min to city centre. The same businessmen who complain of the long road journey to Prestwick, which takes 55min as against 35min to Abbotsinch, daily make an hour's road journey from London airport to the city centre, without option of a rail link. Likewise BEA, whose chairman, protesting against possible use of Prestwick, thinks it ridiculous that passengers should be dumped 30 miles out in the country, operate into several new Continental airports and to Gatwick at comparable distance. In each case, as with Prestwick, a fast rail or motorway link is available. Benefits which use of Prestwick would entail and to which these critics naturally make no reference would be: unification of overlapping air traffic control, shorter flying distance on the main trunk routes to the south, all-the-year-round regularity of operations and the integration of international and domestic services on the one airport.

It is estimated that the new Prestwick terminal buildings can be extended to accommodate Renfrew's traffic at but a fraction of the cost to develop Abbotsinch. This saving, coupled with the reduction in operational costs and losses of one airport doing the work of two, is also worthy of urgent consideration.

Ayr DAVID REID

Wishful Thinking?

YOUR editorial in the issue of November 18 on the sale of British arms to Germany and other NATO countries is timely in that it raises certain issues basic to the defence of this country and of the West generally.

You question what it is that has kept us aloof from the European Common Market. Is not the answer to this—as to many anomalies of our policies—that we are still being guided by economic considerations instead of by ideological ones?

The fact is that we *are* at war ideologically now, and all decisions need to be made on this basis. From a number of recent statements to this effect by senior officers, one can quote AVM Traill, formerly NATO Air Commander, North-east Atlantic: "We must have sufficient military strength to guard our freedom—of that I am clear. But guns alone can never answer Communism because they cannot prevent an idea from crossing your borders."

Also Air Cdre Blair-Oliphant, Director of Weapons Engineering at the Air Ministry, until his present Washington appointment, who said earlier this year: "World War Three is a total war because it is an ideological war that is being fought for the hearts and minds of men and nations. In the past, wars have been fought on three fronts—military, economic and political. Today, ideology controls all three fronts and unless we have an ideology we cannot take the initiative on any one of them. Without an ideology we can be defeated separately on each front."

From France, General Stehlin, Commander-in-Chief of the French Air Force and Deputy Chief of the French Defence Staff, has put it this way: "If the free world is not to be out-manœuvred by this new and very powerful weapon, ideology, we must meet the enemy on his own ground and with the same weapon. If we can unite the ideological and military factors, we will have a real defence of freedom."

If this is the situation—and anybody who has read one of the 87 million copies of the Moral Re-Armament manifesto, *Ideology and Co-Existence*, in one of its 26 languages can hardly remain unconvinced—then it follows we need to make sure we not only prevent the war of arms but win the war of ideas.

In view of this, it is disturbing, to say the least, to read in your same editorial, "the whole vast Cold War may before long be an unsavoury memory." What justification is there in fact for such an optimistic statement? Is it not reminiscent of the ultra-wishful thinking frequently heard in the autumn of 1939—"the war will be over by Christmas"?

Now, as then, surely the only way for a war to be ended is for it to be decisively won. No good will be done by deceiving ourselves—that it won't take some doing. As Dr Adenauer puts it, "We are in an ideological struggle. Therein lies the decisive task. It may last for decades but must be won."

As General Stehlin declares, "it is with the weapon of a moral ideology that we will secure the peace and be able to build a new world."

Derby R. P. DUCE

Army Air Corps History

THE comparatively young, newly formed Army Air Corps is already looking back into the past for some history. It has been decided to start a Museum at the Army Air Corps Centre at Middle Wallop (*Flight*, July 29, 1960). Some examples of the early marks of Austers and wartime troop-carrying gliders which were used by our forerunners, the AOP and the Glider Pilot Regt, will be on permanent display.

We are particularly interested in acquiring an Auster Mk 1, a Mk IV and a Horsa and Hotspur glider. If any of your readers have any information on the whereabouts of any of these machines or parts of them in any condition would they write to me at the Officers' Mess, Army Air Corps Centre, Middle Wallop, near Stockbridge, Hants.

Stockbridge, Hants M. SOMERTON-RAYNER, Capt, Army Air Corps

CORRESPONDENCE IN BRIEF

An American Pou-du-Ciel enthusiast is building an HM-360 and wishes to correspond with Pou-builders past and present. He would like to exchange data and photographs. He proposes ultimately to publish a series of articles with a view to reviving home-building interest. Correspondence (in English) should be addressed to: Ralph M. Wefel, EEA 7128, 8400 Fullbright Avenue, Canoga Park, California, USA.

AN AIRSHIP MUSEUM

TO perpetuate the association of RAF Cardington with lighter-than-air craft from 1920 onwards, an airship museum is to be established at the station. *Flight* readers who can assist by presenting or loaning appropriate material (literature, pictures, models or items of equipment) are invited to contact Sqn Ldr J. Blake, Station HQ, Royal Air Force, Cardington, Beds.

AIDING HELICOPTER RESEARCH

AN endowment in the form of a seven-year covenant to a total of £17,500 has been made to Southampton University by Westland Aircraft Ltd to found a readership in helicopter engineering. This follows an expansion-programme appeal made by the chancellor of the university, the Duke of Wellington, and it makes possible for the first time a venue for engineers specializing in helicopter technology. It also offers an opportunity for basic helicopter research under the direction of Prof E. J. Richards, professor of aeronautical engineering at Southampton.

The readership will supplement an earlier contribution of £3,500 by Westland Aircraft, made in 1955 for specific application to aeronautical research and facilities at the university. This has helped to promote investigation into the problems of blade vibration and rotor-blade motion in forward flight, carried out by Dr J. P. Jones, a senior lecturer. It has also resulted in the setting-up of various test units, including an acoustic laboratory—now called the Westland Acoustic Laboratory—and a wind tunnel; and opportunities have been provided for consultant work with the Saunders-Roe and Fairey divisions on blade-tip silencing.

FORTHCOMING EVENTS

Jan. 16-20. Institute of Physics and The Physical Society: Annual Exhibition (Jan. 19—Lecture: "Some Physical Problems in Travelling at Supersonic Speed," by Dr F. P. Bowden).
Jan. 20. RAeS Man-powered Aircraft Group: "Gliding and Man-powered Flight," by Lorne Welch.
Jan. 20. Institute of Navigation: "Presentation of Height Information in Aircraft," by A. Stratton and K. R. Honick.
Jan. 21. Society of Environmental Engineers: Discussion on "Development of Accelerated Climatic Tests."
Jan. 24. RAeS: "Problems of Erosion and Impact," by Dr R. H. C. Strain.
Jan. 24. Society of Instrument Technology (Tees-side Section): "The Experimental Investigation of Space," by Dr P. J. Bowen.
Jan. 25. BritIRE (Electro-Acoustics Group): "Noise Correlation Measurements," by K. R. McLachlan.
Jan. 25. Kronfeld Club: Film of 1958 World Championships.
Jan. 25. Society of Instrument Technology (South Wales Section): "Fire and Explosion Hazard of Intrinsically Safe Instrumentation," by S. J. Emerson.
Jan. 26. Society of Instrument Technology (Chester Section): "Satellite Instrumentation," by R. C. Jennison.
Jan. 31. Institute of Transport (West Middlesex Group): "Air Transport in Russia Today," by Capt G. A. Yarotski.
Feb. 1. Kronfeld Club: "Army Flying," by Maj P. A. Downward.
Feb. 1. RAeS Agricultural Aviation Group: "The Economics of Agricultural Chemicals and Fertilisers," by J. C. Pinder.
Feb. 2. RAeS (main lecture at Swindon Branch): "Nuclear Propulsion for Aircraft," by A. D. Baxter.

RAeS Branch Fixtures (to Jan. 27): Jan. 20, *Hatfield*, Social. Jan. 23, *Glasgow* (Graduates' and Students' Section), "Building and Light Aircraft," by Dr Roche; *Henlow*, "Supersonic Civil Transports," by R. G. Thorne. Jan. 25, *Weybridge*, "The Exploration of Outer Space," by J. A. Ratcliffe.

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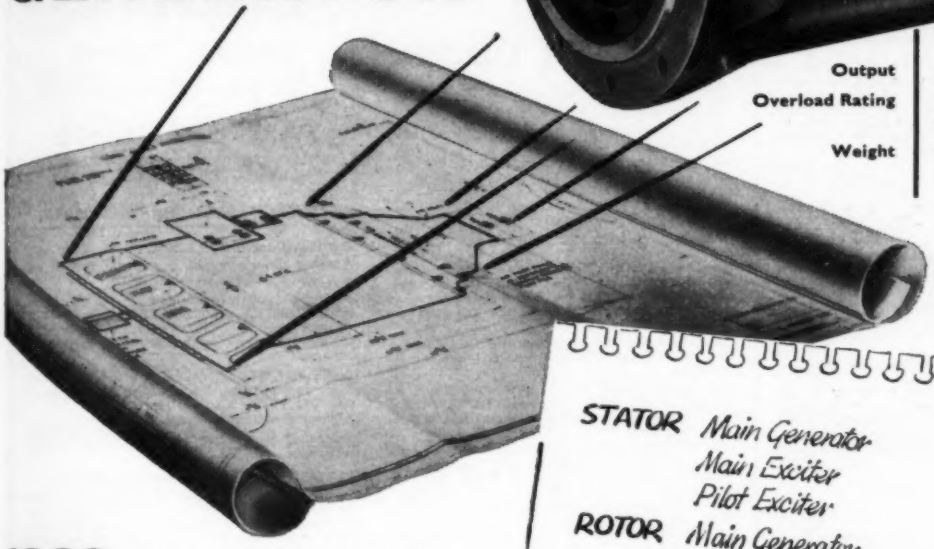

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to study the application of existing, and future, guidance, control and power systems to new projects devised by the group.

QUALIFICATIONS — Senior engineers: wide electronics and electrical engineering experience; able to take full advantage of new developments in detection, tracking, navigation, control and power generation equipment. Junior engineers will have some, but not all of these qualifications.

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to study tactics and performance of various weapons and space systems, and to prepare guidance and control systems design specifications. The senior engineers will contribute to, and interpret, overall strategic studies and initiate detailed work on them.

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to study weapon design, aircraft installation problems and space flight equipment.

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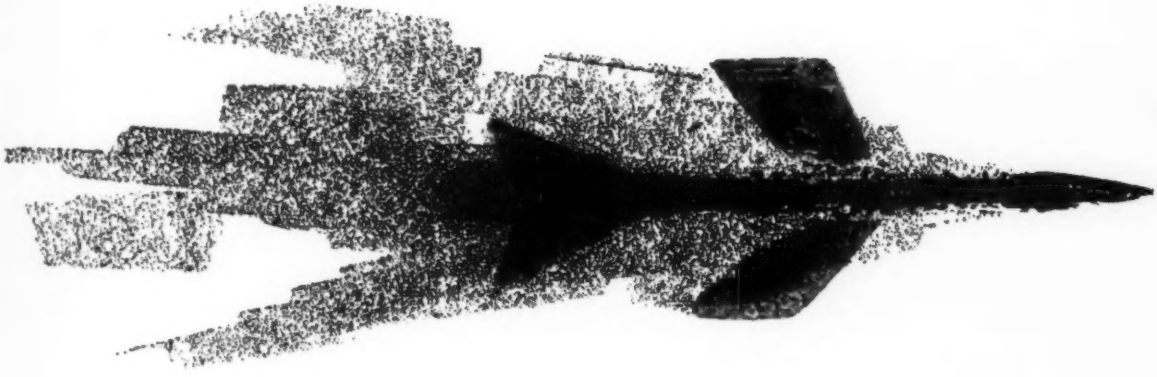

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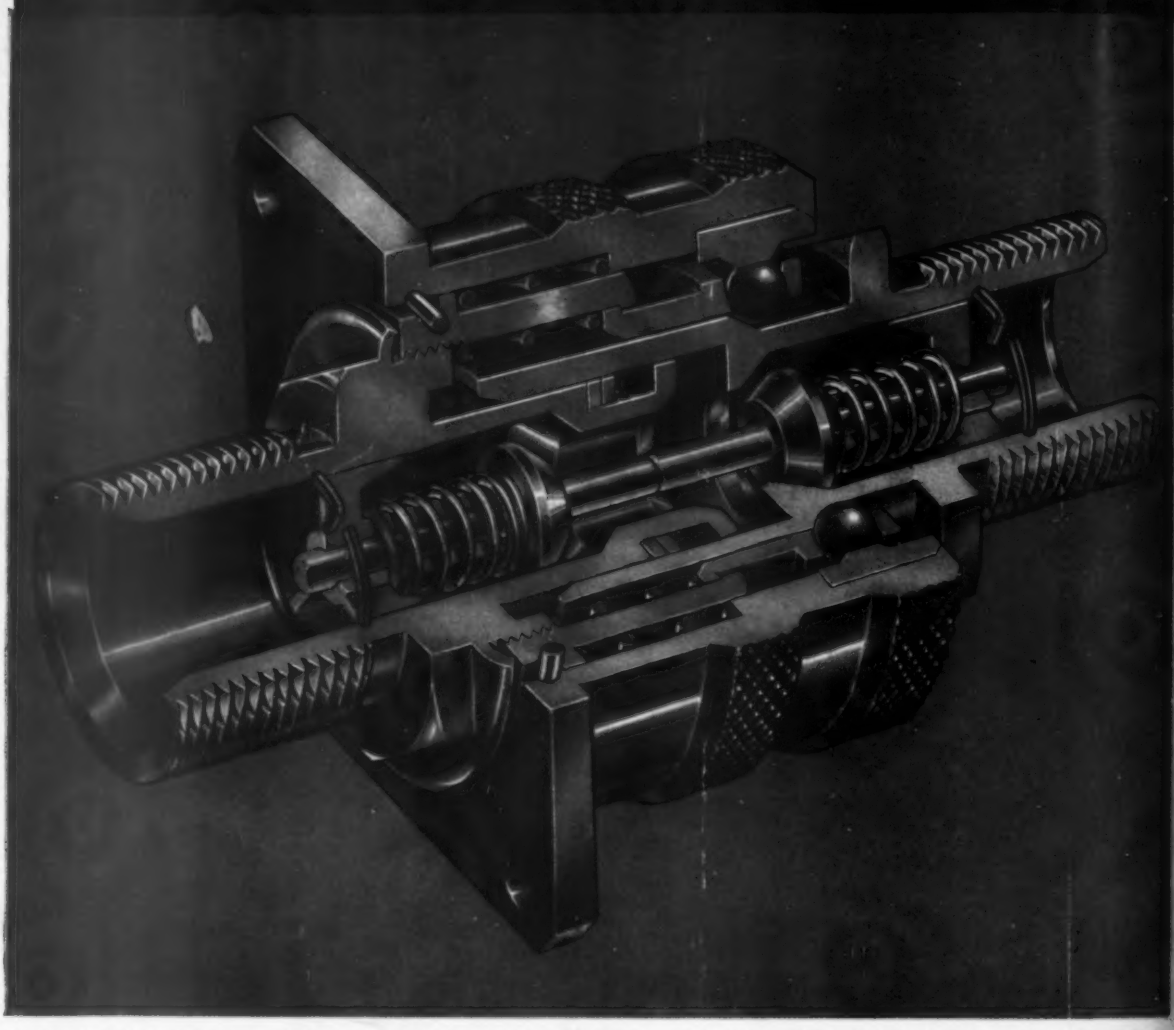

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